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ABSTRACT

Two sections of this newsletter are concrened with describing the present activities or curriculum projects and professional societies, in Great Britain, in the areas of science education and mathematics education. Announcements of general education activities, two articles concerning science education projects in Australia and Peru, seven short articles describing international conferences, an annotated publications list of science and science education books, and seven abstracts of journal articles and papers in science education also are contained in this document. (DT)

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THE BRITISH COUNCIL

U.S. DEPARTMENT OF HEALTH
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EDUCATION

Science Education Newsletter

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SEN No 24

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ACTIVITIES IN BRITAIN - SCIENCE

1. Nuffield Foundation Science Teaching Project - Revision

1.1 Revision of Nuffield O-level Biology, Chemistry and Physics, published for the Nuffield Foundation by Longman/Penguin Books

New editions of the Nuffield O-level courses are in active preparation. The editors of the revision have undertaken thorough studies of the effectiveness of the first editions in schools and have engaged in exhaustive consultations with teachers. The new editions thus profit from the many comments and criticisms they have received.

Nearly every book is being redesigned, and full colour illustrations are being introduced where appropriate. The publishing schedule is:

Biology	-	from mid 1974
Chemistry	-	from late 1974
Physics	-	from early 1975

The first edition publications will continue to be available as long as existing stocks last.

For further details, watch out for the 1974 editions of the Longman School Science catalogue and the Penguin Secondary catalogue.

Biology - General Editor Miss Grace Monger

The 5 Texts and Teachers' Guides of the present edition are replaced by 4 Texts and Guides. Text 1 forms the introductory course covering the first 2 years of work, and includes a much more extensive treatment of reproduction, growth and development. In Tests 2, 3 and 4 there is greater flexibility of use - the material has been grouped according to its subject matter rather than in strict teaching order. Text 2 covers work on growth and form, and physiology, Text 3 ecology and behaviour, Text 4 genetics and social aspects of biology. In the Teachers' Guides there is greater emphasis on specific objectives.

Chemistry - General Editor Dr R B Ingle

In the first 2 stages, the 'Sample Scheme Stages I and II: The Basic Course' and 'Introduction and Guide' are replaced by 2 volumes entitled 'Teachers' Guide' 1 and 2. The corresponding material for the pupil is contained in 'Experiment Sheets' 1 and 2 (replacing 'Laboratory Investigations' Ia, Ib and II). The original Background Books are replaced in Stage I by the 'Study Sheets' and in Stage II by the 'Handbook for Pupils' and 'Chemists and the World'. A greater emphasis is now given to the current social implications of science, particularly in these two latter books, which are illustrated partly in full colour. The 'Handbook for Pupils' also contains tables of data and a glossary which replaces the present 'Book of Data'.

Physics - General Editor Professor E M Rogers

The most notable feature of the revised Physics is the 'Pupils' Texts' books 1-5, which offer a varied diet of teaching, helping pupils to learn and think but seldom giving ready-made answers. The present 'Question Books'

are withdrawn, although much of the material they contain is incorporated in the 'Pupils' Texts'. The 'Pupils' Texts' are accompanied by corresponding 'Progress Questions Books', which are designed for slower pupils in GCE forms. For the teacher, the present 'Teachers' Guides' and 'Guide to Experiments' are combined into 5 new 'Teachers' Guides', thus gaining compactness and avoiding duplication of commentary or instructions.

The Publications are:

Biology

Text 1	Introducing living things
Text 2	Living things in action
Text 3	Living things and their environment
Text 4	The perpetuation of life
Teachers' Guide 1	Introducing living things
Teachers' Guide 2	Living things in action
Teachers' Guide 3	Living things and their environment
Teachers' Guide 4	The perpetuation of life

Chemistry

Stage I	Teachers' Guide 1
	Experiment Sheets 1
	Study Sheets
Stage II	Teachers' Guide 2
	Experiment Sheets 2
	Handbook for Pupils
	Chemists and the world
Stage III	Teachers' Guide 3
	Option pamphlets combining experiment sheets with background reading

Physics

Pupils' Text 1	Teachers' Guide 1	Progress Questions 1
Pupils' Text 2	Teachers' Guide 2	Progress Questions 2
Pupils' Text 3	Teachers' Guide 3	Progress Questions 3
Pupils' Text 4	Teachers' Guide 4	Progress Questions 4
Pupils' Text 5	Teachers' Guide 5	Progress Questions 5

For further information write to:

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Longman House
Burnt Mill
Harlow
Essex
CM20 2JE

Schools Unit
Penguin Books Ltd
Harmondsworth
Middlesex
UB7 0DA

1.2 Nuffield Foundation Science Teaching Project - Chemistry Advanced Level

The Nuffield Foundation Science Teaching Project would like to offer a warning note about experimental work in Topic 10 of the Advanced Chemistry Course. There appears to be a slight risk that a mixture of acetone and chloroform can explode under suitable conditions. Full details are given in a note from Professor E H Coulson in School Science Review Vol 55,

No 192, March 1974, pages 596 and 597. It is suggested that this experiment on hydrogen bonding in Topic 10 be modified and that section 10.1c be withdrawn from the Nuffield A-level chemistry course.

2. The Science Teacher Education Project (STEP) (See SEN 15.4, 18.16)

What is STEP?

Science courses in schools have changed dramatically over the last decade and now attempt to meet a wider range of educational purposes than ever before. Consequently, new demands are placed upon both new and practising teachers, but their training has not always prepared them adequately for the range and variety of pupils, activities and challenges with which they will have to cope.

The Science Teacher Education Project, with generous support from the Nuffield Foundation, brought together some 50 science tutors in colleges and universities throughout the United Kingdom, under the leadership of John Haysom and Clive Sutton of the universities of Reading and Leicester. They pooled their ideas and over a period of 3 years tested and modified them with the help of 200 of their colleagues. The results are presented as a resource bank for others to draw from in framing their own courses.

What does it offer?

- Activities for students whether they be school or college based.

- A fund of tested ideas having great variety of content, form and utility but all student-centred and demanding participation: audio/video tapes, film loops, slides, pupils' writings, case studies, simulation exercises, discussion papers.

- Linking with theoretical studies such as psychology and sociology but in highly practical 'Monday morning' form, with the focus firmly on the classroom.

- The first coherent and extended attempt to develop the scientist's professional skills as a teacher.

The materials of the project will consist of:

Activity Books	Activities and Experiences Theory into Practice
Resource Books	Readings in Science Education Through the Eyes of the Pupil Meadowbank School Film Review
Enrichment Material	The Art of the Science Teacher Innovations in Teacher Education Plus: Slide sets Film Loops Video Tapes Audio Tapes

The main project books are published by McGraw Hill Ltd, Maidenhead, Berkshire.

Activity Books

Activities and Experiences: This is an activity book containing in 416 pages a bank of ideas for use in colleges, universities or teachers' centres when designing a course. It is intended for use by college tutors in education and in science departments; HMIs; LEA Advisers; School heads of departments; librarians in teachers' centres. It contains around 100 activities each of approximately one hour's duration which concentrate on the student's learning rather than the tutor's teaching. Each activity takes full advantage of the range of appropriate resource materials and is designed to have considerable appeal to the student.

Theory into Practice: This is an activity book for teachers in schools or students on teaching practice. It is not intended as a set of 'shallow end' exercises but it isolates aspects of the practising teacher's job and shows how theory relates to conditions as they actually are in school. It is intended for use by students on teaching practice; teachers in their induction year and experienced teachers have all claimed considerable benefit from reading this material during its trials. It has a place on the shelves of all those responsible for training or retraining teachers in the secondary or middle schools. Like Activities and Experiences this book is organised around topics - the teacher can dip into an area of difficulty and compare the alternative approaches considered there as a way into the solution of his problem. It contains practical studies of what teachers and pupils do and relates the activity to underlying principles of educational theory. Some 33 activities are suggested.

Resource Books

The 2 activity books, one college- and one school-based, are supported with 'on the shelf' resource materials - 4 books, sets of slides, audio/video tapes and film loops. Their overall aim is to give the tutor a means of diversifying his activity away from the lecture, putting materials into the hands of his students and giving him more of a consultant's problem-solving role.

Meadowbank School: Case studies in Education, edited by Roy Schofield: This is an on-the-shelf resource for science tutors who seek a participative learning situation. The problems and events in the science department of Meadowbank School raise the day to day issues facing a teacher in his relationships with pupils and colleagues, providing material for simulation exercises and discussion groups. It is intended for use by groups of student teachers, probationary teachers and in-service teachers taking further professional training. As special features it has high human interest and 'real world' problems which involve students deeply; it provides a broad coverage of issues - of interest to students beyond science disciplines; and each case study has a short introductory comment by the editor and is followed by a number of questions highlighting specific problems.

Through the Eyes of the Pupil, edited by C G Carré and J O Head: Teaching is primarily the art of communication; it is as important to study the children's reactions as it is to consider the teachers' stimulus. This book records the response of a wide range of children to their teacher's actions, and it is annotated by the editors. Students both of science and of education; teachers seeking to improve their techniques; and parents will find this book of interest. It carefully links with the child study sections of the main course in education - here are real examples of what children think, write and do. It contains facsimile reproduction - blots and all - of children's work; several hundred examples were selected from over 10,000 scripts together with a linking commentary and annotation by the editors which raises questions and relates the examples to relevant parts of educational theory.

Readings in Science Education, edited by E W Jenkins and R Whitfield: This provides in a convenient and accessible form a comprehensive range of readings from the literature of science education which will be valuable for all specialist science students and teachers. The selection reflects the international appeal and applicability of science education but also draws significantly on hitherto untapped British sources. It deliberately includes opposing and occasionally provocative views to stimulate thought and discussion.

Film Review, edited by M J Graham: This provides tutors with a quick reference to over 90 films about teaching methods in science, in sufficient detail for them to develop their curricula appropriately. It is a detailed 'blow-by-blow' account of each film together with the timing of individual sections permitting detailed course planning without the need for extended appraisal sessions. Also provided is a commentary on ways of using film by a panel of experienced science education tutors.

Enrichment Material

The 2 Activity books and 4 Resource books are supported by 2 enrichment texts designed to go quite deeply into crucial areas of education. In The Art of the Science Teacher the leaders of the STEP writing groups provide a unique and authoritative review of the issues and practices currently informing science education. Science students and teachers will find in this book a thoughtful and stimulating guide to the present state of their chosen profession. Innovation in Teacher Education written by the project coordinators, describes how this project evolved and developed in the light of these practices. It is intended for those who wish to develop curricula appropriate to a modern environment - tutors, advisors, supervisors, and teachers - and has considerable interest for those developing curricula in other fields.

Audio Tapes, Video Tapes, Slide Sets and Film Loops

A considerable number of non-book resources are associated with the STEP project. They interlink with the published materials, extend the range and variety of the tutor's resources and provide opportunities for students to develop pedagogic skills associated with audio-visual materials.

Audiotapes:

Aims are fundamental
Classifying educational objectives
Aims are not everything
Do atoms exist?
Families of animals
Attending to what pupils say
Conservation and reversibility
Who will understand what the teacher says?
Pupils' use of scientific words
Encouraging pupils to learn by talking
Constraints on the choice of method
The use of duplicated lecture notes
After the accident...
Understanding the technician's point of view
The science teacher and the comprehensive school
The science teacher and multi-ability teaching
Resources for science teaching

These may be obtained from Discourses Limited, 34 High Street, Tunbridge Wells, Kent.

Videotapes:

Pupils' understanding of classification
Different styles of teaching
Movements and expressions indicating understanding
Pupils of low ability: some of the problems
Manipulative skills
Estimating ability
Oral examination in chemistry
The safe use of glassware
The science teacher and the comprehensive school
The science teacher and multi-ability teaching
Resources for science teaching

These may be obtained from Brunel University Television Service, Brunel University, Kingston Lane, Uxbridge, Middlesex.

Slide Sets:

Project work
The use and misuse of visual materials
The time needed for assimilation of visual materials
Why topic work?
Spot the hazard
Viewing many laboratories
Storing materials
Designing simple apparatus

Film Loops:

Distribution of materials
The safe use of pipettes
The safe use of burettes

These may be obtained from The Slide Centre, Portman House, Brodrick Road London SW17 7DZ.

3. The Chemical Society, Curriculum Subject Group

The Curriculum Subject Group of the Chemical Society's Education Division issued their first Newsletter in November 1973. The annual general meeting of the Section was held at the University of Leeds in July 1973 and the Newsletter, which is edited by Mr M J Tomlinson of the Grammar School Ashby-de-la-Zouch, Leicester LE6 6DH, is the latest outcome of the activities of this group. The current Newsletter abstracts some information from the third Newsletter of the Group for Research and Innovation in Higher Education (see SEN 23.16) and surveys some developments in undergraduate teaching relevant to chemistry.

The Newsletter also reports on a conference held at the University of East Anglia on Thursday, 27 September 1973, on the subject of Student Difficulties - Causes and Cure. It reports addresses by Dr A H Johnstone, University of Glasgow, who has been examining areas of difficulties at sixth form and undergraduate level; and Mr I M Duncan, who has been considering the problem of whether difficulties in understanding chemical topics arise from unsuitable teaching methods or to inherent conceptual problems associated with maturity barriers. A research student at the University of Glasgow, Mrs Kellett, described work on the investigation of possible reasons for problems which lower grade pupils have with condensation, hydrolysis and esterification reaction, with particular attention to the visual aspects. Mr M J Galton, of the

University of Leicester, was concerned that those about to undertake curriculum renewal or research in tertiary chemical education should learn from the earlier experience in secondary schools. He felt that the project-based method of organising curriculum development was felt to have been a failure since teachers taken from schools to form a team rarely returned and the adaptation of the project of real classroom situations was rarely studied, and furthermore projects often stopped and funds expired. He preferred a school-centred model for curriculum development.

Mr Norman Booth, HMI, described the work of the study group set up by the British Committee on Chemical Education to look at mathematics problems in school chemistry (see SEN 24.14). Dr J R Parsonage of Thames Polytechnic described some student difficulties at the secondary/tertiary interface.

It is clear that the design of new chemistry courses in future will be based on a far more realistic understanding of the pupils' needs and problems than in the past and the holding of this particular workshop is a marked step forward in our approach to curriculum design in chemistry. The Curriculum Subject Group is headed by Professor A K Holiday, Department of Chemistry, University of Liverpool, and its Secretary is Dr D E Billing of the Council for National Academic Awards, 3 Devonshire Street, London. Further information on the Group, or on the Newsletter, can be obtained either from Dr Billing or from the editor of the Newsletter, Mr M J Tomlinson.

4. Science in a Social Context (SISCON)

The SISCON project is an attempt by a group of universities and one polytechnic working together to produce either an alternative or an additive to the traditional first degree courses in science. Each institution works autonomously towards the general objective of courses in which emphasis is placed upon the social aspects of science. Sociological, economic, technological and ecological effects of science in the environment are to be considered together with the effects and influences of society upon science.

Some financial support is supplied by the Nuffield Foundation and the institutions involved are the Universities of Aston, Edinburgh, Leeds, Leicester, Manchester, Stirling, Surrey, Sussex and the Middlesex Polytechnic. There follows a brief resume of the activities in each of these:

4.1 Aston University - Integrated Science Studies

The course aims to give a broad general education based on the fundamentals of the pure, applied, natural and social sciences. Entrants will be required to possess A-level qualification in a science and an arts subject plus preferably mathematics. First year studies cover the basic groundwork in physical, biological and social sciences with mathematics and statistics. Second year studies include scientific method, computing and interdisciplinary work on 'Materials', 'Systems' and 'Science Technology and Society'. In the final year each student undertakes a project on an interdisciplinary problem.

4.2 Edinburgh University - Science Studies Unit

This is not a full degree course but forms 4 units for students majoring in any of the sciences or engineering subjects. The aim is to look at science as a social institution, from a social, historical and philosophical perspective. Course 1 looks at the ideas and concepts of science and the intellectual role of the scientist. A subsidiary portion considers the moral and religious implications of scientific thought. Course 2

contains sociological topics including growth of the scientific community, problems of scientists in industry, the impact of technology on society and the social impact of scientific concepts and beliefs. Course 3 discusses aspects of the social history of science from antiquity to the 20th century and Course 4 looks at science and technology in contemporary social affairs. Case studies are used where possible to highlight themes such as 'Third World Development', 'The Environmental Crisis', 'Computers', 'Automation' and 'Leisure'.

4.3 Leeds University - Combined Studies Programme

The science faculty at Leeds has developed numerous joint courses which are coordinated by the Combined Studies Department. Some of these courses cross faculty boundaries.

4.4 Leicester University - History and Social Relations of Science

This course is available in both the Faculty of Arts and Faculty of Science and it may be taken for 1 or 2 years either as a Combined Studies subject or as a supplementary subject in many single subject degrees. The overall aim is to study the role of science in the shaping of modern society and discussion is centred on 4 topics.

a. 'The Scientific Revolution' concentrating on the emergency of science as a recognisable entity in the 17th century.

b. 'Science in its Social Context' examining the way in which scientific research and other social and intellectual activities such as religion, education and war have mutually influenced each other.

c. 'The Growth of Modern Science' considers how scientific thinking has evolved to its present state.

d. The organisation and communication of science studying the structure of science and the nature of scientific growth.

4.5 University of Manchester - Honours School of Liberal Studies in Science

There are 2 separate undergraduate programmes in Manchester, one based on physical science, and the other starting for the first time in 1974, based on the life sciences. Liberal Studies in Science occupies approximately half the time in each of the 3 years within either of these 2 programmes. Topics covered include economic history, contemporary social problems of science, the role of science in innovation, science and government, and science and society.

4.6 Middlesex Polytechnic - Society and Technology

This is a degree course constructed around 2 core courses of which one concentrates on developing the philosophical and methodological foundations of the social and natural sciences as they have developed throughout the ages and the other is a laboratory and seminar programme in communication and problem solving. It is intended that these will constitute Part 1 of the degree course covering 7 academic terms. Part 2 begins with a 9 month out of college placement whose objectives are:

a. To experience at first hand the value systems of industry, government or research organisations.

b. To apply the knowledge and skills gained in Part 1 in a 'Real World Situation'.

c. To gain sufficient knowledge of the 'outside world' to place studies into a perspective and select final year topics.

This placement leads directly into the final year which examines the complex relationship between society and technology. Case studies and a group project are undertaken.

4.7 University of Stirling - Integrated Science

This is not a full degree course but is regarded as a 'major' subject which may be linked with other courses offered in the University.

4.8 University of Surrey - Physical Sciences with Science Education

It is intended that this course will start in 1974 and will concentrate on a combination of physical science and science education. The physical sciences component will occupy most of the first 2 years and a portion of the final year and will cover the fundamental principles of chemistry, physics and mathematics as integrated parts of a unified course. The education component is not intended as a professional training but rather as a broadening influence on intellectual development. It will study educational issues, the history and philosophy of science, the social aspects of science and technology, educational technology and will include visits to schools.

4.9 University of Sussex - History and Social Studies of Science

Again not a full degree course, this is merely an element in first degree courses. Science undergraduates may follow first year studies in the historical development of science, and interrelationships between science, technology and society, and History and Social Studies students may choose from a rather extended selection of topics for their own units. These latter include science and literature, science and developing countries, political and moral philosophy in relation to the technological society and economic aspects.

It is evident from the above that the approach, course content and design varies considerably between universities. It is hoped that an Executive Committee will coordinate the work and that a number of short term appointments of research fellows will assist the development of new methods.

Further information may be obtained from The Project Coordinator, Dr W F Williams, Room 9/83, Physics/Administration Building, University of Leeds, Leeds LS2 9JT.

5. Primary Schools Biology Scheme, Edinburgh

The bulletin of the University of Edinburgh, Volume 10, No 2 of October 1973 reports on the activities of the Edinburgh Primary Schools Biology Scheme. This scheme planned to use students studying biology or medicine to help introduce environmental studies to children. More generally such students acted as a biology source upon which teachers could call, backed up by equipment and materials readily available from the universities and as an aid to teachers attempting work in the outdoor. Environmental studies of a kind are taught in some primary schools but tend very much to depend on the teacher's own experience. Some teachers who would like to introduce more biological ideas to children feel their own background of the subject is inadequate and this was designed as an additional input in such areas.

The scheme began in 1971 with 13 schools, and in the third year a total of 24 schools and 50 students are now taking part. The organisers have been greatly impressed by the dedication and enthusiasm of the students and there is a feeling of an immense, largely untapped talent among the students for work with young children. Students are allocated to a particular school and stay with them throughout the year in order to develop a good working relationship. The students are assistants to the teacher who retain full responsibility for the class. Work has been conducted largely in primary classes 4, 5 and 6 with students making weekly visits during term. The report describes approaches that have been tried with the classes ranging from straight talks to the use of living material which proved extremely successful as were some dissections. Outside visits were also attractive. The mechanisms of borrowing university material will need to be strengthened as the system develops. A need for an increase in the availability of visual aids was identified. The organisers of the scheme are Dr A Manning and Dr E Rogers from the University of Edinburgh, and J R Barr, Science Adviser, Edinburgh Corporation Education Department.

6. Association for Science Education - Annual Conference Leeds 1974

The Annual Conference of the Association for Science Education held in Leeds from 1-4 January 1974 proved to be one of the most successful conferences yet, despite a spell of very cold weather coinciding with problems of energy generation in the United Kingdom. It was attended by over 1500 visitors from outside the UK many of them from the Third World. Innovations in the programme this year included the arrangement of a series of symposia coincidental with a visitors day. The symposia covered 'Science in the Middle Years' and 'The Teaching of Technology within School Science'. Both were very well attended. It is intended to repeat this pattern in future years. 'Visitors' in the above context means day visitors from the locality rather than overseas visitors.

In accordance with the established pattern two lectures on aspects of science education overseas were included in the programme. The first of these was given by Dr G Howell, Head of the Science Education Section of the British Council, under the title of 'Science Education and Development in the Third World'. This talk covered various aspects of educational development ranging from decisions as to the direction in which society should progress and the relevant education for this progress to occur, to more specific conclusions on the nature of science education in school and the arguments in support of integration of science studies both within themselves and with other areas of the curriculum as a key feature in establishing relevance in various educational contexts. The second overseas science education session took the form of a presentation on international developments in integrated science teaching under the chairmanship of Mr D G Chisman, Deputy Director of the Curriculum Division, CEDO. This took up and extended one of the themes of Dr Howell's talk and analysed a number of integrated science schemes including the West Indies Science Curriculum Innovation Project.

Also in accordance with accepted practice an extensive exhibition of materials from science education development activities overseas was arranged and showed a very strong emphasis on integrated science activities. Exhibits concerned with the work in progress in the Caribbean, Ghana, Kenya, Lesotho, Malaysia, Malawi, Nigeria, Sierra Leone, Sri Lanka, Swaziland and Zambia were presented.

As an experiment, the major proceedings of the annual meeting for 1974 will be the subject of a special ASE publication to be entitled 'Some Proceedings of the Annual Meeting 1974'. This will be about 40 pages in length and will appear shortly, price 25p, available post free from The Association for Science Education, Publications Officer, College Lane, Hatfield, Herts, AL10 9AA, England.

At a discussion session at the end of the meeting, suggestions for activities concerned with the overseas aspects of science education for the annual meeting for 1975 were discussed and it was agreed that these should focus on the activities of Science Teachers Associations around the world. Subsequently it was agreed that the meeting might take the form of a special symposium on the activities of such Science Teachers Associations and the present suggestions are that the second day of the meeting, namely Wednesday, 1 January, take the form of an overseas day which might include activities on the following lines:

Overseas Science Education Symposium: Science Teachers Association in Educational Development

Wednesday am	i.	The development of professionalism in science education
	ii.	The contribution of professional associations to curriculum change
pm	i.	Study of exhibition of materials from Science Teachers Associations worldwide
	ii.	Discussion of cooperation between professional associations (ICASE - see SEN 22-29)
	iii.	British Council/ASE reception for overseas visitors.

Arrangements for this meeting will be coordinated between the British Council and the Association for Science Education. It is proposed to contact Science Teachers Associations overseas through British Council representations and other organisations where appropriate during the middle of 1974 to organise as comprehensive a representation of global activities in this field as possible.

7. Continuing Mathematics Project (See SEN 20.14)

This Project is now under the directorship of Mr R W Morris, formerly Director of the Curriculum Division of CEDO. The Project was established by the National Council for Educational Technology following the publication of the Council's working paper No 2 entitled 'Continuing Mathematics'. It aims:

- to meet the mathematical needs of sixth formers not taking the subject as a main study, who in their future studies or later employment would benefit from a greater understanding in more mathematics than is provided in the O-level/CSE courses;

- to exemplify in meeting this need the systematic design, development and evaluation of a variety of materials for individual and small group learning which will:

  a. improve the student's capacity to function as an independent learner;

  b. assist the mastery of some mathematics appropriate to the student's needs;

  c. promote satisfaction in the study of mathematics and a willingness to undertake further study;

  d. be a resource of teaching aids and ideas for teachers.

- to develop an understanding among teachers of the role of counsellor in relating student need to available resources.

Further information can be obtained from the Project Director or from the Schools Council Project Information Centre, 160 Great Portland Street, London W1N 6LL.

8. Mathematics for the Majority - Continuation Project (See SEN 12.9, 14.14, 17.8, 18.20, 19.9)

The first 2 packages of materials, entitled 'Buildings', and 'Communication', will be published in early summer 1974. Their contents, cover a wide range of topics. The publishers are Schofield & Sims Limited, 35 St John's Road, Huddersfield, HD1 5HY. Sample lists of the contents are given below.

Buildings

B1 Don't Collapse
B1.1 Rigid Structures (Information Cards)
B1.3 Packet Biloflex Strips, Nuts and Bolts
B1.4 Strength and Shape (Work Card)
B1.5 Packet of Washers
B1.6 Getting the Corners Square (Work Cards)

B5 A Roof Over Your Head
B5.1 How Big is a House (Work Card)
B5.2 Survey on Housing (Work Card)
B5.3 How Long does a House Last?
B5.4 Set of 6 SHELTER leaflets 'A Home of Your Own'.

Buildings (continued)

B7 A Model Cathedral
B7.1 Plans and Elevations (Work Card)
B7.2 Set of 5 View Cards (1-5)
B7.3 Packet Centicubes
B7.4 Durham Cathedral (Work Card)

B14 Saving Up
B14.1 Saving Up Rules of Game
B14.2 Pad or Saving Up Sheets plus loose strawboard
B14.3 Saving Up Mask Card
B14.4 Packet of Paper Money and Plastic Coins plus 12 Turn-up Cards
B14.5 Pad of Money Spent Sheets
B14.6 Pad or Savings Sheets

Communication

C1 Newspapers 1
C1.1 A look at the papers
C1.2 Pages for a penny
C1.3 A survey of readership

C2 Newspapers 2
C2.1 Detective work
C2.2 Numbering the pages
C2.3 Area of a newspaper
C2.4 Content of a newspaper
C2.5 Two cm^2 grids on acetate

C3 Words and letters
C3.1 Length of sentences
C3.2-7 Letter frequency (6 workcards)
C3.8 Morse code
C3.9 Cassette tapes - Morse code

C4 The Telephone
C4.1 Getting the message
C4.2 Local telephone calls
C4.3 John in London
GPO Broadsheet 'Post Office Tower'

C9 Letters, paper and envelopes
C9.1 Size of letters
C9.2 Cardboard rectangles
C9.3 Writing paper and envelopes
C9.4 Aspect ratio measurer
POP Ervelope leaflet

C13 Travel to School
C13.1 First in - Rules
C13.2 First in - Games Board
C13.3 First in - Games Counters
C13.4 Cardboard dice
C13.5 First in - workcard
C13.6 Travel to School - a survey
C13.7 Travel to School - Summary sheet

C14 Postage
C14.1 Where to put the Postbox
C14.2 Pillar to post
C14.3 Hidden information

9. Sixth Form Mathematics Project (See SEN 21.17)

This project has been granted an extension until September 1976. This will allow for the dissemination of the project's ideas and materials; the continued development of the examination in 'basic applicable maths' including carrying out official pilot trials in 1975 and 1976 with a London examination board; the provision of further support for the project's trial schools; and the production of additional material to widen the appeal of the basic course for specialist groups rather than attempt to produce an A-level course.

10. The Scottish Mathematical Council

The Scottish Mathematical Council is an independent body set up in 1967, whose aims are to foster and improve mathematical education at all levels and to encourage the advancement and application of mathematics throughout Scotland. The Council represents all levels of interest including schools, institutions of higher education, HM Inspectorate and business interests. The present chairman is Professor W D Collins of the University of Strathclyde.

Activities include sponsorship of a fairly large number of one day conferences and follow-up regional meetings on a variety of topics, the instigation of a number of investigations such as student attitude to teacher training, performance at university against entrance qualifications and the national picture of in-service work. A number of school Project competitions are organised. The SMC is now one of the bodies consulted on syllabus and examination development and works closely with affiliated institutions representing local and professional groups. A Newsletter is published annually and further information regarding this may be obtained from Mr D S MacNab, Department of Mathematics, College of Education, Hilton Place, Aberdeen, AB9 1FA.

11. Scottish Secondary Mathematics

11.1 Scottish Mathematics Group (See SEN 18.19)

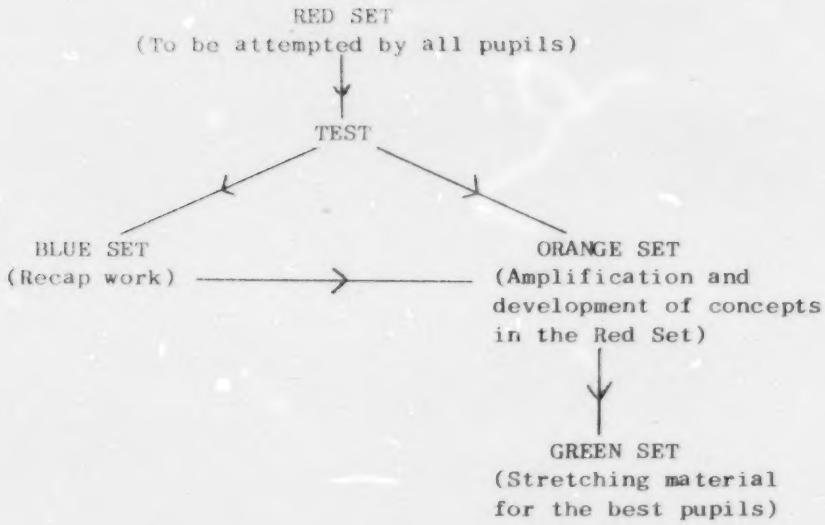
Production of the revised series of 'Modern Mathematics for Schools' has now reached Book 6, and Book 7 will be published later this year. It was intended that the parallel 'A' and 'B' exercises introduced into this series would cater for the majority of pupils, with set A covering the entire syllabus and set B probing further into the topic concerned for use by the more able. However, the introduction of mixed ability classes into the first years of Scottish secondary education encouraged the Group to consider the problem of less able pupils. As a result new 'Mathsheets' (worksheets) are being produced which contain questions and assignments designed to gradually develop the various topics in 'Modern Mathematics for Schools' but also to form a close link with current primary school courses. The Mathsheets should provide an element of individualised learning in addition to normal class instruction and assist the teacher in coping with classes containing a wide ability range. Publication of the first sheets should occur in autumn 1974 and will consist of pads of A4 size tear-off sheets with one for each Exercise in Book 1.

A further innovation will be the production this year of a set of 24 Overhead Transparencies to accompany Book 1. Each transparency will comprise a main frame and an average of 4 overlays contained in a folder with teacher's notes. The producers emphasise that the aim is to exploit the facilities offered by the overhead projector in, for example, transformation geometry and not merely to reproduce textbook illustrations. Further information is obtainable from Blackie & Chambers.

11.2 Modular Mathematics Organisation

Materials suitable for use in S1 and S2 mixed ability classes have now been tested in 27 pilot schools throughout Scotland over a period of 3 years under the direction of the Scottish Mathematics Committee (See SEN 18.17). Careful dissemination and feedback has led to considerable revision and rewriting and for publication purposes a sub-group of Committee members have formed themselves into the 'Modular Mathematics Organisation'.

As the name suggests, the individualised learning work is organised into 'modules' or units consisting of a mixture of workcards, worksheets and apparatus. Each develops a particular mathematical situation or topic and contains about 2 weeks' (6-8 hours) work. Variations in ability are catered for within each module by the following sub-divisions designated by colour:



As can be seen from the above, it is intended that all pupils progress through a red set of cards and sheets. At the end of this a short test will determine whether they proceed to the more difficult 'Orange' exercises or attempt the 'Blue' set which recap in different situations the ground covered in the Red. Those pupils who hope to ultimately complete a certificate course in mathematics should complete both the Red and Orange sections. The content of these has been written accordingly and the 'Green' set remains merely as stretching exercises for the most able. Additional Example Books are supplied to provide homework or further practice.

The modules have been grouped into cycles of 4 in which each is independent of the others. This will enable pupils within the same class to work on different modules concurrently. Organisation is ultimately the responsibility of the individual teacher and those who prefer to continue with a little class teaching may choose only one module at a time for the entire class. Modules 1-18 aim to cover work in S1 and will be published by Heinemann later this year. Modules 19-36 covering S2 work will follow in 1975. It is intended that Modules 1-36 should form a self-sufficient introductory course from which pupils can proceed either to the existing 'syllabus A' 'O' grade examinations, GCE O-level or CSE examinations or the proposed Scottish Syllabus B. Further information may be obtained from Mr D Smart, 8 Inverallan Drive, Bridge of Allan, Stirlingshire.

11.3 New Mathematics Syllabus B

A New Mathematics, Syllabus B, is currently under construction and is the second remit of the Secondary Mathematics Committee. The aim is to produce a 2 year course with syllabus covering S3 and S4 grades leading to the 'O' grade examination. Pupils entered for the course will probably be those who do not intend to continue with mathematics to a higher grade. Trials of S3 materials were begun in the 27 pilot schools mentioned above in October 1973. S4 work is currently under construction. The approach will not be a modular one but will consist of 'units' which may ultimately be bound in textbook form. Progress on the syllabus will be reported in later editions of this Newsletter.

11.4 Mathematics for General Education

A National Committee for Mathematics for General Education was recently convened to investigate the problems of S3 and S4 pupils who will not follow a certificate course. This is obviously particularly important in the context

of the recent raising of the school leaving age. The Committee discussed requirements and possible approaches and it has been decided to provide 'enrichment' material rather than a specifically structure course. Trials are currently proceeding in 13 pilot schools and publication is not envisaged for at least another 2 years.

Work has been produced in units of varying lengths. Approximately 50 have so far been composed and the ultimate aim is to provide a large volume of material so that the teacher has considerable freedom of choice in its use. The Committee has elected not to follow a particular 'theme' (cf The English Mathematics for the Majority Project centred on 'the environment') although individual topics may cover a number of units. Some activities are in the form of a short game lasting for merely one class period, whereas others involve investigations and surveys covering several weeks. Similarly the format varies with a few units in worksheet form whilst others have been produced as booklets. Topics so far suggested include traffic surveys, games of chance, work on electricity and on newspapers.

11.5 The Fife Mathematics Project (See SEN 20.13)

This project has continued to develop since the initial success of the pilot project in 1970-71. Many of the materials have been revised and rewritten on the basis of the trials and the 20 workcard booklets are now in use in most Fife secondary schools. Interest has been aroused in other regions of Scotland and although originally aimed at the 12-13 year age range (S1), consideration is being given to the possibility of including the top class in primary schools.

Throughout the project the Director has emphasised that it should be seen as a way of working in the classroom and not merely a collection of materials or a complete 'introductory course'. The intention is to encourage a flexible mixture of individualised learning and conventional class teaching whereby the proportions of each are left entirely up to the teacher. Some have elected to use the project work in discrete blocks of a few weeks whereas others have devoted a certain amount of time per week to the 2 methods of working. No attempt is made to cover a particular syllabus but rather to highlight the basic concepts in mathematics and to stimulate pupils to follow up any particular topics which arouse their interest.

11.6 Dime Projects (Developments in Mathematics Education)

In association with the Fife project 'Dime Projects' were formed in the autumn of 1973 to publish and produce Fife and other mathematical materials. The group has a particular interest in 'manipulatives' and have already produced some original ideas for tessellating tiles, press-out cardboard 2 and 3 dimensional objects, reflecting boards and wooden block combinations.

11.7 Mathematics Education Research

A further development has been the establishment of a small research unit within the Department of Education in Stirling University. A 3½ year study of how pupils can be helped to learn mathematics was begun in January 1972 with the aid of a grant from the Scottish Education Department. The objectives of the research are:

i. the development of concepts and models for the better description of the observable and internalised processes involved in learning mathematics;

ii. the comparative study of the effectiveness in school use of experimental material designed by the National Mathematics Committees (see paragraphs above) and others;

iii. a clearer understanding of the mechanisms that promote mathematical activity and facilitate mathematical learning and the development of a range of catalysts appropriate for classroom use.

In the theoretical research it will be taken as an initial working hypothesis that a pupil's attitude to mathematics is a major fact affecting his attainment and potential. It will be assumed that a positive attitude is desirable.

The group have recently been extended with an added grant from the Scottish Education Department in order to investigate the ways in which modern technological development can be used to create classroom equipment. Emphasis is placed upon materials which are both cheap and effective in helping children to learn and understand mathematics. It is hoped that a range of 'manipulatives' will be developed to assist in the understanding of fundamental concepts.

12. Scottish Computer Education

12.1 Computer Courses

12.1.1 After the recommendations of the Bellis Report (see SEN 15.9), various groups throughout Scotland have produced ideas and short courses on Computer Appreciation for pupils who will not continue to any formal study of computer science. Many schools are now running some form of course and 2 formally published versions have recently emerged.

12.1.2 The Scottish Computers in Schools Project have designed a course reviewed in SEN 19.12 entitled 'Yours Obediently'. Aimed at the 'average' pupil of 13-15 years, it was hoped that teachers of any discipline could use the materials without previous experience in the subject. Part 1 on 'How a Computer Works' was published in 1972 and Part 2 on 'The Historical Development and Wide Range of Computer Applications' appeared in 1973. Part 3 on 'Programming' will be published in 1974. Further information is available from Chambers, 11 Thistle Street, Edinburgh EH2 1DG.

12.1.3 Another course which will shortly be published by Oliver & Boyd is entitled 'Computers in Action'. Written by a team of Edinburgh-based authors the course shares similar aims of providing a computer 'appreciation' course for the middle secondary pupil and for staff not necessarily engaged in mathematics teaching. Basic materials will consist of a textbook and set of worksheets with 2 teachers packs including 35mm slides and overhead transparencies. The text is designed not merely to give information, but to provide ideas and stimulus for pupils' own assignments and projects, some of which could be easily integrated with courses in other subjects such as history. Topics covered in the chapters are:

How much do you know already about computers?

How did it all begin? - historical development

What is a computer? - the computer in the context of other machines

What does a computer System look like?

How does a computer handle a problem?

Solving a problem (including flowcharting and programmes)

Input and Output

Applications A to Z

How is Information stored? (Central processor and backing)

What language shall we use?

Living with computers.

It should be noted that these are trials suggestions only and that the final format may differ slightly. The textbook should be marketed at 60p and worksheets at 25p per set. Further information may be obtained from Mr T H Fairlie, Dean Education Centre, Edinburgh.

12.2 Computer Centres

12.2.1 National Centres

Four National Educational Computing Centres have now been established in association with the 4 National Curriculum Development Centres in Aberdeen College of Education, Dundee College of Education, Moray House College of Education, Edinburgh, and Jordanhill College of Education, Glasgow. Three of the centres have their own computers and Dundee uses a local Technical College facility. It is intended that schools in each area should be encouraged to make the fullest use of the opportunities offered for class and individual work. Pupils involved in the appreciation courses mentioned above might make a weekly or fortnightly visit to their centre to observe all aspects of a computer in action and later to run short programmes which they have written. The latter may be sent by post in advance for punching by Centre Operating staff as a time-saving service. Students studying computer science in more depth are enabled to pursue their own interests during weekday evening opening periods, and the centres clearly provide a valuable resources for teachers.

12.2.2 Scottish Computer Education Group

In order to exchange ideas and stimulate new developments members of the centres have formed themselves into an informal group entitled Scottish Computer Education Group. Meetings are held approximately once a month and have now been in progress for 3 years. A Newsletter is produced 3 times a year. The Group ensures that the developments within each area and centre may be viewed in a national context and encouragement is given to teachers' conferences, workshop activities, inter-school competitions, and the production of a variety of 'packages' for use in mathematics and other subjects. Packages so far produced, for example, include games on Investment, Football Forecasting, Fashion, and House

Purchase, and services to Geography in the form of a Meteorological Data File, Choropleth and Isopleth mapping. Further information on these and the Newsletter may be obtained from Mr B Parker, Computer Centre, Moray House College of Education, Hollyrood Road, Edinburgh.

12.2.3 A Travelling Computer

A particularly interesting development at the Aberdeen Centre has been the introduction of a travelling computer. The area covered by the Aberdeen Centre is a somewhat remote and rugged region of north and north east Scotland including offshore islands, and clearly few schools had easy access to the computer when housed in Aberdeen. A NOVA 1220 mini-computer was therefore purchased and specially packed for transporting. The basic components consist of a 16k store, a mark sensed card reader and a teletype terminal which can be packed in separate boxes. By the end of September 1973 the computer had already used sea, air, road and rail transport with great success and a large number of pupils had had the advantage of 'first hand' experience. Schools can prepare for the arrival of the 'travelling mini' by using the postal system to send programmes for advance punching. It is hoped that by Easter 1974, travelling magnetic tape cassettes will have been added to the system to enable the use of package programmes, ALGOL and FORTRAN and other aspects such as file handling for business studies classes. Further information may be obtained from Mr N Smart, Computer Education Unit, Aberdeen College of Education, Aberdeen.

12.3 Glasgow Computer Centres and Education

The development of computer education and particularly computer assisted instruction has followed a separate path in the city of Glasgow. With all the problems of a large urban area the Corporation have long given support and backing to a variety of schemes directed and chiefly initiated by Mr Ian Watt, Mathematics adviser to the Corporation. The chief developments in progress are:

- The provision of Computer Centres

Computer Centre I was opened in 1967 within an existing Teachers' Centre, followed in 1970 by Computer Centre II on a separate site. It is hoped to open 2 further centres in the future which will cover the remaining half of the city. In concept the centres differ slightly from the national facilities described earlier as the emphasis has been placed upon removing the pupils from their school environment for 'lessons' and study at the centres under the tutelage of staff with considerable industrial experience of computers. School staff have comparatively little role in computer education - a situation which is perhaps easier to organise in an urban area where whole classes can in theory travel to a session in a relatively short space of time. The 2 existing centres have an IBM 1300, 16k store complex with card input and line printer. Classroom facilities are available for the resident teaching staff and groups of up to 20 pupils at a time may be accommodated. Individuals can also take advantage of the centres during the week and during certain evening periods.

- Computer courses have been written informally by centre staff and several Educational Television series have been made for use on the city's closed circuit system.

- Computer Assisted Instruction

This is an important scheme which is only in its initial stages at the moment but it is hoped that terminal facilities will not be limited to the secondary schools but extended into primary schools also. The Corporation have just announced approval for the first 10 primary school terminals.

13. Mathematics Advisory Unit, University of Nottingham School of Education

In June 1965 the Joint Mathematical Council of the United Kingdom published a report on in-service training for teachers of mathematics. This report pointed out that there existed a great need for in-service training at that time and gave a number of reasons for this need. The report also made 4 recommendations.

13.1 That as a matter of urgency facilities be provided within the school's structure for serving teachers, to develop their knowledge and efficiency preferably by setting up mathematics centres under local education authorities.

13.2 That each Institute of Education set up an advisory unit to assist all the agencies in helping the in-service training of teachers of mathematics within its region.

13.3 That a permanent sub-committee of the Schools Council for the Curriculum and Examinations be set up to work for the development of in-service training facilities for teachers of mathematics.

13.4 That a National Information Centre be established to provide a communication link between all people concerned with the teaching of mathematics in schools and be a source of information in all developments and publications in the field of mathematical education.

In respect of recommendation 13.2 it was suggested that the Institute of Education would appoint a mathematical specialist with appropriate experience who would have 2 main functions.

- Executing the work of the Advisory Unit

- Organising the Institutes contribution to the work with serving teachers of mathematics.

Areas of work in the Advisory Unit included making available information on forthcoming courses and other activities available to teachers of mathematics in each area, surveying the effects of the various courses and activities on the basis of information gathered, preparing a report for the guidance of organisers of future work and publishing a bulletin which would contain accounts of experimental work being done in schools and other material of interest to teachers of mathematics.

The University of Nottingham set up such an Institute in September 1966 with the appointment of a tutor with responsibility for the setting up of the Advisory Unit in addition to lecturing duties within the Institute. The Advisory Unit is organised by a representative committee drawn from all aspects of mathematical education area and this meets once a term to discuss the activities and make plans for further development of the Unit. The detailed activities of the Mathematics Advisory Unit in the University of Nottingham have been documented by D A Sturgess the tutor to the Nottingham Mathematics Advisory Unit and cover the first 6 years of its work from 1966 to July 1972. This publication is available from the University of Nottingham School of Education, University Park, Nottingham NG7 2RD free of charge.

In recent years the Advisory Unit has produced a number of other publications notably a 'Framework for Mathematics Teaching in the Primary School' by D Sturgess, price 50p; 'Mathematics Teaching in Secondary Schools' by D Sturgess, price 35p, and 'Modern Mathematics in School and Further Education: a discussion report' free.

14. Mathematics and School Chemistry

Early in 1973 the British Committee on chemical education requested a study group to enquire into all aspects of the interaction between school chemistry and mathematics. An interim report has now been published and it indicates those areas where further information is needed or awaited. A detailed account of this has been published in 'Education and Science' January 1974, pages 14-21. ('Education and Science' is the Bulletin of the Association for Science Education and is obtainable from the Association at College Lane, Hatfield, Herts, England at 40p including postage).

The problem is seen as falling into 3 areas:

14.1 What legitimate objectives of a school chemistry course are being hindered stage by stage by what weaknesses in mathematics?

14.2 What if anything are the techniques and processes which are being taught under the general heading of 'New Mathematics' from the use of which chemistry could benefit?

14.3 In what ways if any can chemistry teachers cooperate with their mathematics colleagues in improving the mathematical competence of their pupils?

Evidence was obtained from chemistry and mathematics teachers through the Chemistry Teachers' Centres or the Chemistry Section of Science Teachers' Centres. In addition the Joint Matriculation Board made possible a scrutiny of O- and A- syllabuses and examination papers in chemistry for the summer 1973 examination and arranged a meeting between the chairman of the British Committee on Chemical Education group and the chairman of examiners at both O- and A-levels. It is further proposed to study marked scripts in due course in order to see whether it is possible to identify two groups of candidates, those who have taken modern mathematics and those who have not. A similar exercise is proposed for the London Examinations Board.

A check list of mathematics for chemistry was prepared which listed all the mathematical abilities thought likely to be required in an 11-18 chemistry course. Teachers were asked to say which of the 3 stages before 13, 13-16 and 16 plus required what mathematical abilities and technique. In addition various individuals supplied information and the working group scrutinised the report of the Institute of Physics Working Group on the mathematical requirements of school physics (see SEN 22.11). The answers to the 3 questions outlined above suggest that the only really satisfactory area in terms of mathematical training is in the sixth form and only then when the pupil is also taking A-level mathematics. In relation to specific techniques and processes it appeared that there are a number of mathematical skills which teachers feel they must have at a particular stage of the course. For example, in the first 3 years of the course when dealing with combustion, atoms and molecules, the concepts of weight and volume have to be developed and mathematical skills such as the 4 rules, direct and inverse proportion, positive and negative, ratios, percentages, indices, use of logarithms, fractions and decimals, graphs, use of slide rule, and averages are all required. Further groupings of skills in relation to chemical topics were also drawn up. It was often felt that the

problem was not that the mathematical topics had not been met with but there had been inadequate practice in their use. There was some suggestion that new or modern mathematics was felt to be the culprit.

There seems to be some disagreement in relation to the possibility that areas of mathematics could conveniently be taught in chemistry classes. Answers ranged from "None" to "All that is required". Clearly however there is the problem of the transfer of a mathematical technique into a chemical situation; in fact the technique as such is often the least part of the problem. It was felt that there was some sort of a language barrier between chemists and mathematicians. There is clearly need for a wider dialogue between chemists and mathematicians and a study of modern mathematics by chemistry teachers could be complemented by the use of some areas of chemistry in mathematics teaching.

The interim report goes on to consider the mathematics concepts which are felt to be necessary at the various stages of the secondary school and points out that most of these are taught in the majority of O- and A- mathematics courses. A list of recommendations are given, the first of which is that chemistry teachers within a school should draw up a list of mathematical requirements of their course in the time order in which they are required. They should then discuss the implications with those of their colleagues who are also concerned in physics, biology, geography and craft subjects and most important of all with the teachers of mathematics. The report comments that science teachers will be well aware of very similar problems as between the 3 sciences and the progress which has been made towards the solution of these inter-science subject problems. They will therefore accept, we hope, that the mathematicians have their own job to do as they see it and that some compromise will certainly be needed by both sides.

For a fuller account of this report the reader is referred to the above report in 'Education and Science'.

15. The SRA Algebra Skills Set

Work in algebra falls into 3 main categories: the structure of mathematical systems, word problems and practice. In order to give sufficient practice time to students following an exam-based timetable the structural aspect has often been forced into the background. In modern mathematics far more emphasis has been placed on structure with an inevitable loss of valuable practice time. As a result many students cannot carry out algebraic operations with fluency. In order to deal with this problem the Science Research Associates Limited have produced an Algebra Skills kit. It does not set out to teach structure as they feel that this can best be accomplished by the teacher. Instead it is intended to provide each student with an individual practice programme in the basic skills.

The components of the kits are:

- A survey test: this helps to locate the student's weak areas although it cannot provide a detailed diagnosis of those skills required in practice.

- The diagnostic test: the 12 separate tests of these are contained in pads of 30. From the results of the survey test the student is directed to take one or more diagnostic test each of which examines one area of algebraic skills.

- Exercise cards and reference cards: these form the bulk of the Algebra Skills kit. Reference cards review each topic, define terms and symbols

and provide background to each section. The exercise cards are in pairs giving examples and showing the working of a particular type of problem and offering several problems for the student to solve.

- Progress tests: for every section there is a progress test appearing in the student record book. The test is taken when the student has completed a section. The answers are multiple choice and the answer key is in the Teachers' Handbook.

Also provided are a student record book which contains the survey test, progress tests, answers to diagnostic tests and instructions for the use of exercise cards etc. In addition, a Teachers' Handbook is provided which is a concise guide to the introduction and use of the kit. It also contains the answer keys and a class record.

The subjects covered by the exercise cards are: integers, rationals, expressions, mathematical sentences, exponents, polynomials, rational expressions 1, rational expressions 2, radical expressions, linear and quadratic equations, graphing and the coordinate plane and trigonometry. The Algebra Skills kit provides a programmed course of individualised practice in the basic skills of algebra. For further information write to Science Research Associates Limited, Reading Road, Henley-on-Thames, Oxfordshire, RG9 1EW, England.

16. British Thornton Electronic Calculator Selection Service

British Thornton Limited have recently established a new service to education covering electronic calculators. This is a particularly difficult field for the uninitiated to venture into in view of the confusing range and variety of equipment now available on the market and the rapidly changing features of many models. British Thornton have chosen from the many models available those calculators which their research has shown best fulfil the needs of education. In doing so they have concentrated on calculators where design and quality are the important factors in construction. British Thornton do not claim that the calculators chosen are the cheapest nor that they alone have useful features. They are chosen however as British Thornton's assessment of the best value for money when all aspects of calculator use are considered. The calculators in the selection are offered at special educational prices through British Thornton. The calculators at present concerned are Texas Instruments TI 2500, Texas Instruments SR 10, Bowmar MX 40, Bowmar MX 70 and Sinclair Cambridge in the portable electronic calculator range. In the desk top electronic calculator range, Texas Instruments TI 3500, Texas Instruments TI 4000, Bowmar TX 400, Bowmar TX 700. For further information please contact British Thornton Limited, PO Box 3, Wythenshawe, Manchester, M22 4SS.

ACTIVITIES IN BRITAIN - GENERAL

17. General Education in Engineering

The General Education in Engineering Project (GEE) was founded by teachers at the universities of Liverpool, Newcastle, Nottingham, Warwick, Aston, Birmingham, Bath, Exeter and Oxford and at the Oxford and Portsmouth polytechnics. The GEE project sets out to make engineering education:

- more effective in terms of personal development
- more responsive in meeting the needs of society
- more complete in its approach to professional responsibility.

It will attempt to meet the increasing questioning attitude to technology among young people, the demand for education rather than something which they identify merely as training, the probability that an increasing number of engineering graduates may wish, or be obliged, to compete for jobs outside engineering, and the demands made on the versatility of those who do become professional engineers.

The project has recently produced the first copy of its Newsletter entitled 'FRAME'. In explaining this title, Dr D M Brancher, the Project Coordinator writes:

> "Engineering is an activity which appears in a framework determined by the culture of our society. The work which engineers do, are expected to do, are expected to leave to others; the attitudes they are likely to express; the values they ascribe to this or that; all of these are more or less confined by a frame of convention. The frame has been set up by history, most of it comparatively recent, and by the accumulation of personal experience. Within this frame is the image of a profession.
>
> The frame and the image tend to be self-perpetuating because the profession (like any body of people) tends to fulfil the prophecy it reads in the eyes of those outside it. The frame changes only when the engineer sees a new shape, and fills it out with a performance which is convincing to others, which comes to be accepted and which he feels to be expected of him".

It is the intention of the GEE project to widen the frame of engineering education and indirectly to widen the frame within which the student allows himself to develop. The Newsletter of the project carries brief accounts of education in member departments of the GEE project. Number 1 contains an account of engineering science at Exeter and industrial studies at Liverpool. A number of workshops were held during June 1973 as the initiation of the GEE project. At present the project development team is considering the type of materials they would wish to sponsor and are planning detailed development of the project. From the beginning the group has accepted 3 foci of interest - Enterprise, the Third World, and Cities. The first of these is given a head start by its established relevance to engineering and its presence already in many engineering courses. Of particular interest to readers of SEN will be the commitment to the Third World. The Project Coordinator has set up a liaison committee with the Intermediate Technology Development Group, OXFAM, the Voluntary Committee for Overseas Aid and Development, Anti-Poverty Limited and with an observer from the Ministry of Overseas Development.

'FRAME' is edited and produced by the GEE Project Office, University of Aston, Gosta Green, Birmingham B4 7ET, from which further information can be obtained.

18. Educational Technology and the Expansion of Education - National Council for Educational Technology

Recent educational policy papers in the United Kingdom 'Education a Framework for Expansion' and 'Education in Scotland: a statement of policy' have prompted the National Council of Education and Technology to issue a statement in respect of the role of educational technology in attaining the objectives outlined in such policy documents. The Council believes that the developments foreshadowed for the next decade can be fully achieved only if there is a corresponding development of educational technology in schools, colleges and universities. It suggests areas in which opportunities exist for developments in educational technology and proposes mechanisms and provision required to realise such opportunities. Development areas include:

Individual and small group study
The enhancement of teaching
The use of recorded lectures and demonstrations
Cooperative preparation of study materials
Learning at a distance
Use of radio and television for curriculum development
Changed patterns of educational provision.

They suggest that adequate provision must be provided for:

Guidance to teachers on the selection of methods, resources and devices when designing courses
The training of student and practising teachers in the concepts and techniques of educational technology
Supplies of equipment, books and other resources
The effective use of radio and television educational broadcasts
Services for the setting up and maintenance of equipment in the learning situation
Library collections of study materials in each institution and local authority area
The special preparation of study materials in each institution and local authority area
Regional and national cooperation in the preparation of study materials
Specialist advisory information services in relation to all aspects of educational technology
Design or adaptation of buildings to permit full use to be made of new methods and degree sources.

The report then proceeds to elaborate these points in some detail. Where possible the National Council encourages specialist agencies to provide National Support Services in educational technology. In an appendix the document lists relevant National Council of Educational Technology activities including the following:

Colleges of Education Learning Programmes Project
Support materials for in-service training
Innovation development project
Information systems
Media cataloguing rules
Higher Education Learning Programmes Information Service (HELPIS).
Copyright negotiations
Timetabling by computer
National Development Programme in computer assisted learning
Continuing Mathematics Project
Primary Extension Programme
Standards and specifications for educational and training equipment.

The pamphlet also lists the current publications of the NCET. Further details can be obtained from the National Council for Educational Technology, 160 Great Portland Street, London W1N 5TB.

19. Engineering Science, Loughborough University/Schools Council (See SEN 21.18)

This project has been granted an extension from 1974 to 1976. This will allow for the launching of the published materials later in 1974 and the organisation of training courses and conferences, the continuing support for schools working in this area, and an evaluation of the success of the engineering science development. In addition two industrial concerns have promised funds to support the continuance of development of the OND in Technology (Engineering) in the further education sector and the project will provide textual support for this.

20. Examinations and Assessment

A Conference was organised by Chelsea College and the National Foundation for Educational Research on 6 and 7 September 1973 on the subject of examinations and assessment. There were 4 lectures from distinguished speakers and a variety of seminar groups. Some 150 people were present representing schools, universities, colleges of education and examining boards.

The principal lectures were concerned with the major questions facing schools examining boards in regard to reform of examination patterns at the present time, and is indicative of the high degree of concern for such matters in the United Kingdom. The topics were:

Examining at 16+
Development towards a certificate of extended education
Examining at 18+
Examinations in relation to the curriculum

The seminar groups covered a variety of topics including:

Objective testing
Assessment within a mixed ability group situation
Comparability of standards
Continuous assessment
User requirement
Training in assessment procedures
Administration of examinations
Examinations - future developments
The Rasch model (a means of using one set of validated items to standardise attainment in others)
The Open University approach.

E O James writing in 'Education and Science' November 1973 comments: "It is fashionable to view the matter of examinations with disfavour, but how else can we seek to quantify what this costly and time-consuming business of teaching has achieved? Education is over-diffident about any attempt to analyse its attainments and the Conference will be amply justified if it has furthered the prospect of more professional approach to assessment".

21. The Nuffield Foundation Group for Research and Innovation in Higher Education, Newsletter No 3, October 1973, published by the Nuffield Foundation, Nuffield Lodge, Regents Park, London NW1 (See SEN 23.16)

The first two Newsletters in this series contained short accounts of a relatively large number of interesting innovations in most subject areas which

the Nuffield Foundation Team discovered during academic visits. As a result of these visits it was possible to arrive at a tentative list of generally relevant issues and recurring topics. Meetings of small working groups were held to explore these in more depth. At these meetings the groups of academics, often following on from a preliminary paper prepared by the Nuffield Team, discussed the following topics:

The Context of Innovation

Student Assessment

Practicals and Projects

Interdisciplinarity

Broader Education

Independence in Learning

Academic Structure

Course Development.

The Newsletter contains a summary of each topic discussed and in some cases carries proposals for future action. The emphasis on case study work is seen as an attempt to specify particular problems.

The Nuffield Team welcomes comments and responses from readers on suggestions for student assessment particularly in the field of student profile assessment and on suggestions about development needs and priorities in respect of Educational Development.

22. PUBLICATIONS

22.1 A Handbook of Biology Teaching Methods, Mollie Pullan, Oxford University Press, price 75p

This is a volume in the Teachers Library published by the Oxford University Press. The Teachers Library is a series of practical handbooks for teachers in both temperate and tropical countries. The books provide the teacher with a framework of different methods and present examples of lessons, tests and various techniques. They include advice on equipment and apparatus and bibliographies for further reference. The series covers a wide range of subjects such as languages, physical education and science, as well as educational psychology, the organisation of libraries and learning through games. A familiar book in the series is:

> Techniques and Apparatus for the Science Teacher, by A G Beleson and H Creaser.

The organisation of this new text by Miss Pullan covers:

> Biology in the school curriculum
> Planning and teaching a course of biology
> Laboratories and equipment
> Schemes of work with practical details.

Biology teachers will find the book a mine of practical information with neat clear diagrams. A further attractive point is that it is produced in paperback at a very reasonable price. It will be extremely valuable for the new and less experienced teacher but there are many aspects which will also be of value to more established science educators.

22.2 Recommended Practice for Schools relating to the use of Living Organisms and Material of Living Origin; Schools Council, published by English Universities Press, price 35p

In response to a recognised need for an authoritative guide and source of reference on dissection for teachers and others, the Schools Council Science Committee convened a Working Party in 1970/71 to examine this subject. As well as this difficult topic they also considered a whole range of problems associated with the use of living organisms in schools. A draft of the Working Party's findings and recommendations was sent to a wide range of interested bodies and also to interested members of the Schools Council, including all the examining boards and their valuable comments were considered by the Working Party and further amendments made.

The first part of the booklet considers the aims of using living materials, the variety of uses to which they can be put, and various safety factors which need to be taken into account.

The second part, the recommended practice, gives under 4 main headings, advice on choosing, maintaining and using the most suitable living organisms for particular purposes in a way totally in accordance with the ethical and legal standards of the United Kingdom.

The text, reference list, and bibliography give addresses of organisations from which further, more detailed, information may be obtained. It is hoped that the results of some 2 years work will be of use to many

teachers not only specialist biologists as well as to the examining bodies and curriculum innovators. The present book was written by John Wray in collaboration with the Schools Council Science Committee Working Party on dissection and experimentation in schools. Mr Wray is a Research Fellow of the Educational Use of Living Organisms Project directed by Dr Peter Kelly, financed by the Schools Council and based at the Centre for Science Education, Chelsea College.

22.3 Human Biology Objective and Completion Tests for O-Level. E Clark editor, published by John Murray, price 65p.

This is part of a series of books of objective and short answer questions which now play an important part in O-level and other examinations. Objective testing has been found to be both a useful examination and classroom teaching tool and the availability of pre-tested collections of this kind is a valuable aid to the teacher. These tests have been prepared and rigorously presented by a team consisting of testing and subject specialists. The book contains answers and scoring notes, and tests could if necessary be administered in a normal classroom period.

22.4 A Bibliography of Resources for Chemistry Teachers, The Centre for Studies in Science Education, University of Leeds, price 50p

This bibliography has been compiled by Mr E W Jenkins, a member of the staff of The Centre for Studies in Science Education, Leeds University. This is an attempt to make more accessible some of the material which has appeared in 3 chemical journals commonly available in schools: 'Education in Chemistry', 'The Journal of Chemical Education' and 'The School Science Review'. Abstracting of 'The School Science Review' started in 1919 but articles prior to 1960 are cited only if they are thought to be particularly useful in the contemporary context. 'Education in Chemistry' has been abstracted since its first publication in 1964 and references to 'The Journal of Chemical Education' began in 1963. In the case of all 3 journals the period covered ends at June 1973. The author draws attention to the fact that cumulative indices are available for 'The School Science Review' and 'The Journal of Chemical Education' covering, in the first case, a period to 1963 and in the second case from 1924 to 1968. The index is to a certain extent selective, and to avoid unnecessary bulk cross referencing has been restricted to essential elements.

The contents are indexed under the headings 'Analytical Chemistry and Stoicheiometry', 'Apparatus and Storage Assessment', 'Atomic Structure and Periodicity (including radio chemistry)', 'Audio-Visual Aids', 'Chemical Games', 'Chemistry in Society', 'Chromotography', 'Comparative Chemical Education', 'Curriculum Development', 'Education and Training for Chemistry Teachers', 'Electro Chemistry', 'Energetics', 'Equilibrium', 'History of Science', 'Industrial Chemistry', 'Kinetics', 'Laboratory Safety', 'Mechanistic Organic Chemistry', 'Methodological Aspects of Chemistry Teaching', 'Molecular and Atomic Models', 'Polymer and Natural Product Chemistry', 'Practical Work', 'Preparative Inorganic Chemistry', 'Preparative Organic Chemistry', 'Programmed Learning and Computers', 'Research in Chemical Education', 'Science in the Junior School', 'States of Matter', 'Structure and Bonding'. This publication will be an invaluable guide for the serious student of chemical education and for all teachers and other people concerned with the development of chemical education.

This publication is available from The Secretary, The Centre for Studies in Science Education, The University of Leeds, Leeds, LS2 9JT. Other publications in this series are: 'Objective Testing: A Guide for Science Teachers' by E W Jenkins, price 30p, 'Biological References from The Journal of Biological Education' and 'The School Science Review' 1960-1972 by M S Gosden, price 45p, 'The Teaching of Science to pupils of Low Educational Attainment' by E W Jenkins, price 45p.

22.5 Structured Questions in A-Level Chemistry by John Gunnell and Edgar Jenkins, published by Oliver & Boyd, price 60p

Recent changes in the style and content of school chemistry courses have been paralleled by corresponding developments and examination technique. These developments in turn have led to an increased awareness of the contribution that different types of question can make to the teaching and learning of chemistry. This bock of structured questions is therefore intended to complement the earlier book by the same authors 'Objective Questions in A-Level Chemistry'. Structured questions have been developed with particular intentions of testing a student's understanding of chemistry and fostering the ability to apply chemical ideas. It is intended that structured questions should make a useful contribution to the normal teaching/learning process rather than be used as the basis of achievement tests, although of course they have a function in the latter category also. The materials are not arranged as test papers but as resource materials for the student. SI units are applied throughout and IUPAC and common nomenclature are given when appropriate. The questions are grouped under Atomic Structure, Structure and Bonding, The Gaseous State, Energetics, Kinetics, Equilibria, The Periodic Table, The Chemistry of the Non-Metals, The Chemistry of the Metals, General Inorganic Chemistry, Hydrocarbons, Compounds of Carbon Hydrogen and Oxygen, The Organic Chemistry of Nitrogen and the Halogens, General Organic Chemistry and Experimental Procedures. This will be a valuable handbook both for student and teacher in developing modern courses at Advanced Level.

22.6 The Polymorphism of Elements and Compounds, Methuen Studies in Science, E W Jenkins, price £1.00

This is a recent publication in the series of Methuen Studies in Science. This particular volume provides a concise introductory survey of polymorphism and is suitable for students in advanced and scholarship levels. It deals with polymorphism as a phase change, polymorphism as an energy change, and polymorphism as a structural change. It then looks at the polymorphism of the S, D and F block elements, polymorphism of the P block elements and finally polymorphism in compounds. It is well illustrated with neat line diagrams.

A number of the general principles governing polymorphism are established and these are illustrated by consideration of the polymorphic behaviour of particular elements and compounds. The text contains a large number of experiments and questions which encourage the reader to seek an explanation of the observed properties of a substance in terms of basic chemical principles. The emphasis is on an understanding of polymorphism rather than on the accounts of behaviour of individual substances. A full list of the titles of the Methuen Studies in Science is given below:

Alternating Currents	J M Gregory
Aspects of Isomerism	Peter Uzzell
Atomic and Molecular Weight Determination	R B Moyes

Catalysis in Chemistry	A J B Robertson
Chemical Equilibrium	J S Coe
Collisions, Coalescence and Crystals	A Ralph Morgan
Crystals and their Structures	J F Roberts
Energy in Chemistry	B E Dawson
Enzymes	Alan D B Malcolm
Fundamentals of Electrostatics	S W Hockey
The Inorganic Chemistry of the Non-Metals	John Emsley
Kinetics and Mechanisms of Reactions	B E Dawson
Logical Control Systems	Keith Morphew
The Mechanical Properties of Materials	R A Farrar
Nature Conservation	W M M Baron
Oscillations	I B Hopley
The Polymorphism of Elements and Compounds	E W Jenkins
Radioactivity and the Life Sciences	D J Hornsey

Forthcoming:

Biological Oceanography	M V Angel
Cell Biology	J Chayen
An Introduction to Genetics	Michael A Carter
Transition Metal Chemistry	J J Thompson
Waves	I B Hopley

22.7 Multiple choice papers in Advanced Level Physics; B Davies, J Charnley, D C Rhodes, published by John Murray, price 70p

This is the latest in a series of books on multiple choice questions and each of the 20 papers in this book consist of 15 multiple choice questions covering a range of topics in A-level physics. The comprehensively indexed analysis of the 1500 responses readily allows location of related questions and enables the book to be used in a variety of ways. Two multiple option papers are included. The questions, all original and in SI units, have been selected from a tested work collection of more than 600, the majority of which have been tested and used in school and college for a period of 5 years or more. As experience with questions of this kind increases this book will find a ready application in the assessment of advanced level physics performance.

22.8 Questions and Problems in Pre-University Physics; P N Whelan and M J Hodgson, published by John Murray, price £1.60

The authors say that the questions in this book have been written with the express aim of developing confidence, understanding and interest in trying to make many of them simple to answer by structuring them in such a way that the student is led easily from one step to the next. The book is not linked in any way to examination technique but it is hoped that its effect will be to improve examination performance by developing a real understanding of the ideas of physics. The questions attempt to put emphasis on the desirability of the student acquiring a feeling for orders of magnitude, a realisation of the importance of energy as a link in concept and a familiarity with microscopic ideas

in the behaviour of electrons, atoms and molecules. The questions are often divided into qualitative and quantitative, the qualitative questions being particularly appropriate for class discussion. The subdivision of the book is into the fairly traditional physics sections of mechanics, oscillations and wave motion, properties of matter, thermal properties of matter, geometrical objects, wave properties of light, soundwaves, electrostatics, current electricity and electronic atomic and nuclear physics. There is a valuable introductory section covering the use of equations and quantities and the definition of physical quantities, together with a section on mathematics for physics which the student and no doubt some teachers will find useful. Hints on problem solving and orders of magnitude are also given. The range of questions is very large and students will find them extremely thought provoking and stimulating. The book is a valuable addition to the literature available for this aspect of the teaching of physics.

22.9 New UNESCO Source Book for Science Teaching, published by UNESCO, price £3.36

The new UNESCO Source Book for Science Teaching has been prepared with the intention of bringing the UNESCO Source Book for Science Teaching up to date and of providing a broader coverage of science teaching material likely to be included in introductory science courses. The revision was coordinated at the Science Teaching Centre at the University of Maryland, USA, under the general editorship of Dr J D Lockard, Director of the Science Teaching Centre.

In preparation for the revision, large scale comment and feedback from users of the previous editions of the Source Book was collected by the World Confederation of Organisations of the Teaching Profession (WCOTP). Teachers organisations and professional associations were invited to contribute suggestions for improvement and a special study was conducted by the Zambian Association for Science Education. Subsequently a meeting was convened under the auspices of WCOTP at which guidelines for the revision were drawn up.

The new publication is divided into 4 basic sections:

- Resources facilities and techniques for science teaching
- Physical sciences
- Biological sciences
- Earth and space sciences.

A useful set of Appendices covers SI Units, Conversion Charts for Units contrary to SI Units, a Periodic Table, a Table of the Elements, Acid Base Indicators, Relative Humidity (percentage) - Degrees Centigrade, Equivalent Temperatures in Different Scales, Logarithms and Geometrical Instruments. The publication is intended to serve as a source of ideas for the devising of simple science activities, investigations and experiments which can be carried out by pupils themselves, and for the construction of simple science equipment using materials available in the particular locality where the science teaching is taking place. As local resources differ widely within a particular country, as well as from one country to another, it is anticipated that each teacher will draw from it material appropriate to the needs of his or her own pupils particular teaching situation. This new and revised edition of the Source Book is a welcome addition to modern science education literature.

22.10 Radio Isotope Experiments in Physics, Chemistry and Biology, by J D Dance, Hutchinson Educational, price £1.75

This book is a considerably expanded and updated version of the author's 'Radio Isotope Experiments for Schools and Colleges' first published by Pergamon Press in 1967. The main object of the 1967 book was to show that a large number of safe and instructive experiments can be carried out using compounds of the naturally occurring radio isotopes together with a few sealed sources. None of the original experiments have been deleted and this book contains the information required by those who do not have adequate facilities for the use of unsealed artificially produced isotopes. Unfortunately naturally occurring isotopes are unsuitable for almost all biological work and for many chemical applications, but small quantities of artificially produced isotopes are available in tablet form at low specific activity. Experiments have been included in the present work which show typical applications of unsealed isotopes in chemical and biological work. No sophisticated counting equipment is required for any of the experiments described in the book. In most cases simple Geiger counting equipment or photographic emulsions are used, but a few experiments using other forms of detector which are often found in schools (such as pulse electroscopes) are included.

The early part of the book deals with the basic background to studies of nuclear radiation covering the measurement of nuclear radiation, naturally occurring radio isotopes, health physics and practical considerations. A wide range of experiments is then described including 13 demonstration experiments, 32 using naturally occurring isotopes, 5 using sealed sources, 24 using artificially produced isotopes, 3 on biological damage. A section on examinations follows and appendices include the 'Regulations and Codes of Practice Governing the use of Radio Istotopes in United Kingdom Educational Establishments', Radio Isotope Data and a table for resolving time corrections for a dead time of 400 micro seconds. The final Appendix lists manufacturers of appropriate equipment and materials.

Radio isotope work has increased considerably in schools in recent years both in depth of content and the range of subjects in which it is included. This text will be a valuable handbook for any teacher contemplating undertaking practical work in this field.

22.11 A Safety Handbook for Science Teachers - J Everett and E W Jenkins, published by John Murray, price £1.50

The subject of safety in laboratories has received considerable attention from time to time from official sources as well as from individual science teachers. However, techniques change and the hazards also, as indeed does our understanding of some of the problems.

On the whole science laboratories are remarkably safe places in which to teach and learn. With changes in the nature of laboratory work, however, there are indications that the present level of safety risk might rise rather than fall. It is probable that most accidents can be prevented by suitable knowledge and adequate planning. In school science teaching careful and thorough organisation is of particular importance, but it demands a knowledge of the likely and possible hazards in each teaching situation. The authors hope that this book will be of help in the planning of lessons and in advising pupils, thereby encouraging the development of necessary safety skills and attitudes in those engaged in experimental science. The material of the book is organised under 'Safety in Laboratories and Workshops', 'Biological Hazards', 'Fire', 'First Aid' and 'The Teacher

and the Law'. It will be a valuable handbook to both experienced and new teachers alike and one which will repay careful study. While much of the information will be familiar to more experienced teachers, the appendices listing all the major hazards reported in the Schools Science Review from 1919 to mid-1972 will be valuable to all teachers.

22.12 Techniques and Problems of Assessment: a practical handbook for teachers, edited by H G Macintosh, published by Arnold, price £2.95

This book contains a list of contributions in the two general fields of Techniques of Assessment and Problems of Assessment.

Under Techniques of Assessment articles cover open-ended questions, instructive questions, short answer questions in objective items, as some of the main features of the examination operation. In addition the analysis of results is looked at under Item Analysis and Question Validation and the Application of Statistics to Assessment. The problems of assessing oral and aural situations and practical and project work are also considered.

Under Problems of Assessment some of the major issues of the current developments and assessment are explored: these include 'Continuous Assessment', 'The Assessment of Attitudes', 'Moderation Procedures', 'School Based Assessment' and 'Curriculum Evaluation'. The presentation of results, question banking and the value for the teacher of research into assessment are also included.

The authors are a widely representative group covering many aspects of educational assessment in the United Kingdom which includes such well known science education people as J F Eggleston, Professor of the School of Education, University of Nottingham, and J C Matthews of the Department of Educational Research at the University of Lancaster.

This is an extremely readable collection of papers which puts together under one cover a wealth of information on modern problems of assessment which will be valuable both to the teacher and to the curriculum developer as well as to the professional examiner. Although a number of the articles become quite technical the authors have been careful to provide appropriate explanation and the themes should easily be followed by the average schoolteacher.

Mr Macintosh is the Secretary of the Southern Regional Examinations Board for the Certificate of Secondary Education and was formerly with the Associated Examining Board.

22.13 Assessment of Attainment in Sixth Form Science; Schools Council Examinations Bulletin 27, Evans/Methuen Educational, price 65p

In its Examination Bulletin 27, a Schools Council Working Party has proposed that sixth form science subjects should be examined by 'a tripartite structure', one part of which would be a 'common core curriculum' to be assessed by a national external authority. The other parts would be an alternative syllabus to be examined by an external authority (presumably the existing regional examining boards) and an element of internal assessment by the teachers. A diagram in the report hints that weights of about 50% for the common core and 25% for each of the other parts of the syllabus would be a sensible division.

22.14 The Teaching of Science to Pupils of Low Educational Attainment, edited by E W Jenkins, Centre for Studies in Science Education, University of Leeds, price 45p

This publication is concerned with those pupils who form approximately 40% of an age group and constitute the majority of those not entered for a public examination of any kind. The booklet indicates what a teacher may expect when working with pupils of low educational attainment and offers suggestions for devising appropriate curricula. The various resources available to a teacher are considered and an estimate made of their usefulness for work with the pupils concerned. There are also carefully selected suggestions for further reading.

The booklet examines some of the causes of low attainment, including 'home background' and 'school factors' as well as 'intellectual factors' and it goes on to examine some of the characteristics of work with pupils in this category including 'vocabulary problems', 'need for reassurance' and 'poor retentive memories'. The section on 'Aims, Content and Method' suggests ways in which a relevant curriculum could be devised. The section on 'Resources and Techniques' points to the value of educational technology in the form of audio-visual material and programmed learning techniques, enabling the teacher to take on the role of 'learning manager' for his pupils.

This booklet will be useful for teachers planning courses of study for pupils of low educational attainment and for student teachers preparing for entry into the teaching profession.

22.15 The Place of Science in Environmental Education, published by the Association for Science Education, price 20p

As the first in the new ASE Study Series, the Education Research Committee have produced a document on The Place of Science in Environmental Education. This arises out of a series of meetings of the Environmental Science Group of the London region of the ASE, and has been coordinated and written by Kate Hinton and John May.

This paper, produced by a small group of teachers, is important for two reasons. Firstly, it represents a serious attempt to define environmental education and the part the sciences could play at school level in developing programmes of environmental education. Secondly, it illustrates the role self organised and directed study groups of teachers can play in contributing constructively, critically and creatively to educational debates. Because the paper represents both a product and a process, the Education (Research) Committee of the Association warmly supports its wide circulation knowing that the ideas it contains will be of use and interest, and in the hope that the method by which they were developed and organised will be copied.

The pamphlet itself looks at science in the context of environmental education and in particular at the contribution from the science area, the importance of skills and attitudes on educational objectives and the place in environmental education in schools. A useful reference list of articles and books relating to environmental education is included.

22.16 Of Measures and of Meaning, by R A Edwards, published by Hutchinson Educational, price 75p

This book is about scientific observation and measurement as well as about the laws and theoretical concepts based upon those observations

and measurements. It is concerned with questions of infallibility regarding scientific knowledge and understanding. It is essentially non-mathematical and tries to present some of the ideas which underline much of the mathematical content of measurement and the quantitative analysis of scientific observation, in a way which may possibly be understood by those without much mathematical ability and even perhaps with no knowledge of physics. The book will be of interest to teachers as well as to students of science and technology and also to those engaged in non-scientific fields of study.

This is a particularly important field and one which is often least well understood, particularly by the non-scientist although the potential future scientist himself may have difficulty in appreciating some of the problems in the field of measurement and observation. As a concise and well written handbook in this field this publication will be welcomed.

22.17 The Development Puzzle, edited by Nance Lui Fyson, Voluntary Committee on Overseas Aid and Development, price 60p plus 7½p postage (including 3 supplements/year)

This publication is a source book for teaching about the 'rich world/poor world' divide, and efforts which are being made towards 'one world' development. Teachers in Britain and overseas countries will find this source book to be invaluable, mainly as a reference source for teaching ideas, pupils activities, illustrative material and background information. Suggestions are given on the use of these materials for the teaching of a wide range of subjects including geography, domestic science, social studies and biology. In addition there is an extremely useful section consisting of lists of available books, booklets, fact sheets etc (many of them free), plus visual materials (wallcharts, photosets, films, film strips, slides) from commercial sources as well as from voluntary agencies.

Voluntary Committee on Overseas Aid and Development (VCOAD)

The Voluntary Committee on Overseas Aid and Development coordinates the educational activities of 8 founder member agencies (Catholic Institute for International Relations, Christian Aid, Freedom from Hunger Campaign, Overseas Development Institute, Oxfam, Save the Children Fund, United Nations Association, and War on Want). The Ministry of Overseas Development and Department of Education and Science also send representatives to Education Committee meetings, as do other agencies (such as the IPPF) who are interested in education in this country on development topics.

This organisation services each year thousands of enquiries for information and materials on world poverty and development, from pupils, teachers and student teachers, and helps with conferences and exhibitions. There is a set of exhibition posters on development education called 'World Poverty and Your School' (price £1) suitable for use in colleges of education and teachers' centres. All enquiries should be addressed to VCOAD, Parnell House, 25 Wilton Road, London SW1V 1LY.

22.18 Intermediate Technology - An Introduction from Voluntary Committee on Overseas Aid and Development, price 25p

This consists of a 'pack' of materials about low cost, labour intensive technology published by the Voluntary Committee on Overseas Aid and Development (VCOAD) Education Unit in cooperation with the Intermediate Technology Development Group. The 'pack' is intended to be used by secondary school pupils and contains:

- Note to teachers

- Printed, illustrated sheets:

  'World Poverty' - what is it? what is life like for the world's poor?
  'World Development'
  'Urbanization'
  'Employment'
  'Intermediate Technology' - what is it?
  'Intermediate Technology' - some examples

- Scripts for role-play

- A Farming Game

- Reprinted articles from 'Undercurrents' (a magazine of alternative science and technology):

  'Water Power'
  'Solar Power'
  'Soft Technology'
  'Organic Fuel'

- More about IT (suggestions of materials, sources on related topics of 'technology', 'power', 'employment', 'environment', etc).

Description of materials produced for Schools Council 'Project Technology', being published 1972-73.

Although the materials are designed for use in schools in Britain, in an attempt to put British pupils into the Third World situation, they are clearly of use for schools overseas, especially in geography classes. The following reasons for teaching 'Intermediate Technology' are put forward:

i. It gives a dynamic picture of a real changing world, instead of a static picture of 'ways of life' in unchanging, fairytale settings - and it removes the idea of one path of 'progress'.

ii. It is sound economics. Most of the Third World has plenty of labour, but relatively little cash; advanced machines cost a lot and can put people out of work. Pupils can understand this as long as phrases like 'capital - intensive' are avoided.

iii. It is sound education. Pupils cannot always understand advanced technology - but they can understand the workings of most IT machines. They can even design their own groundnut shellers!

iv. It is sound geography. Instead of a list of crops and factories one is studying reasons and processes.

v. It is practical. Young people (usually with small personal resources) have to budget their money carefully. Getting the most for the resources one has is something everyone can understand.

The Intermediate Technology Group

This was set up in 1966 as a charity, in London. The Group was started by enquirers and economists and others with experience in the poorer countries of Asia, Africa and Latin America, who have realised that there is a need for single low-cost technology which can be built and repaired

locally - and which creates jobs instead of taking them away. The ITDG has set up 8 panels as follows:

Agricultural, Building, Food, Health, Industry, Power, Water and Cooperatives.

A collection of the latest materials, bulletins etc is contained in an Information Kit, obtainable from ITDG, Parnell House, 25 Wilton Road, London SW1, price 50p.

22 19 Studies in Science Education (see SEN 23, 18.5)

The first edition of a new journal 'Studies in Science Education' appeared in January 1974. It is published by the Centre for Studies in Science Education at the University of Leeds. Its editor is Professor David Layton, Professor of Science Education at Leeds University. This is the first of a series of annual publications which will review research and critical issues in science education. For abstracts of some of the major articles see SEN 24.23). It is hoped that the second issue in January 1975 will contain articles from:

W H Brock, University of Leicester. A review of recent research on the history of science education.

P J Kelly, Chelsea College. A review of studies on the diffusion of science in curriculum innovation.

J J Smolicz,(University of Adelaide). A review of studies in the philosophy and the sociology of science education.

Margaret McCreath, University of Leeds. A review of studies of scientific education of girls.

Paul Gardner (Monash University). A review of studies on children's attitudes to science.

Annual subscription in the United Kingdom and elsewhere overseas is £2.00. In the USA $6.50 including postage. Cheques etc should be made payable to the University of Leeds and crossed. Remittances from overseas should be in sterling. Subscriptions, orders and enquiries should be addressed to the Business Manager, Studies in Science Education, Centre for Studies in Science Education, The University, Leeds LS2 9JT, England.

23. SCIENCE EDUCATION ABSTRACTS

23.1 Early Stages in the Diffusion of the Nuffield A-level Biological Sciences Project, P J Kelly, R B Nicodemus, Journal of Biological Education (1973) 7, (6) 15-22)

Earlier articles have surveyed the evaluation of the Nuffield A-level Biological Sciences Project. This project has now entered the diffusion stage with the publication of its full range of materials and its availability to a much wider range of secondary schools. The diffusion process began in Spring and early Summer of 1970 with 6 one-week briefing courses for 173 teachers. These teachers formed the group on which the diffusion analysis has been performed. A questionnaire was designed and sent to these teachers one year later and covered such topics as sources of information, intention and adoption, implementation, and the characteristics of the teachers themselves. In analysing the returns the authors suggest that the value of the study lies in its analysis of a key group of people and events in the diffusion of a project; one with considerable potential for providing the impetus for the subsequent spread of innovation. Interesting characteristics emerged: the group was apparently more active in communication than any national sample of teachers but the sources of information used were very similar. Contact with other people was confined virtually to teachers in the same or other school. The value of meetings of specialist subject associations is emphasised but the information pattern relating to biology teaching under Nuffield Biology Projects seems to have only a few effective components in each case. The study does not look at the influence of examinations or textbooks and in replies teachers rarely made reference to them. The Journal of Biological Education is published by the Institute of Biology 6 times a year; subscription rates inland and abroad £4.00 + £0.45 postage. Subscriptions from the USA, Canada, Central America and South America $10.80 + $1.20. Subscription orders may be placed with the Institute of Biology, 41 Queen's Gate, London SW7 5HU, England.

23.2 Intellectual Growth and Understanding Science, Kenneth Lovell, Studies in Science Education 1 (1974) 1-19

This paper follows Piaget's developmental theory of intellectual growth and uses it to serve as a conceptual framework inside which the subject is discussed. It points out, however, inadequacies in Piaget's theories and suggests that a more complete theory of intellectual development will emerge in due course. On the other hand it regards Piaget's system,in spite of its inadequacies, as providing the most useful framework available at the present time. The author discusses the conceptual framework for intellectual growth and extends this to look at conceptual patterns in science education. It points out, however, that Piaget's system does not explain why concepts which depend on the same intellectual structure, say first order relations, are not all elaborated at the same time, in order to tell us why strategies of thinking of which the pupil is capable are not used in certain circumstances. The article looks at the period of concrete operations and first order relations and then the period of formal operation of thought and second order relations. It then identifies further weaknesses in the Piagetian model and suggests further opportunities for concrete and formal thinking in science tasks, showing how a mere consideration of an answer to a problem tells us very little about the processes by which the pupil has arrived at the answer, and identifies this problem with different methods of solution of problems, which are related to concrete or formal operational thought. Professor Lovell concludes by suggesting areas of further research in the field.

23.3 Evaluation of Chemistry Syllabuses in Scotland, A H Johnstone, Studies in Science Education 1 (1974) 21-49

The article traces the history of development of current Scottish Chemistry Syllabuses beginning with the early drives for reform in the late 1950s. It describes the techniques used in evaluating the syllabus changes and discusses the results and proposes some consequences for the next generation of changes. Evaluation was attempted in a number of stages. Attempts were made to obtain student reaction to course content by asking pupils who had just completed their O-grade course in chemistry to criticise it. Student reaction was obtained from students in technical colleges, students following sixth year studies courses and first year university students; the results of the surveys are presented. Attempts were also made to obtain assessment of student attitudes to courses as a whole. Attitudes to courses in chemistry are clearly important. Factors such as the age of first interest in science, factive effect in the inclincation towards science were examined. The third survey is concerned with student performance at university. Correlations between O-grade performance and university performance are clearly of interest in validating examination procedure. The performance of a variety of students who had followed three different types of courses are quoted. An analysis is then made of conceptual demands in its relationship to maturity. Two areas in particular are studied. Firstly, formulae equations and the mole and secondly, aspects of organic chemistry particularly hydrolysis and condensation reactions. In the former instance it would appear that the part of the syllabus customarily taught at 14+ to 15+ years of age was conceptually too difficult at this stage in the development of the pupils. Similarly in the organic field, analyses suggest that much of the conceptualisation required is beyond the average pupil at this age. In conclusion the author emphasises that the results suggest a clear warning against curricular changes which are heavily content based.

Other articles in this volume of studies in science education are: M F D Young 'Notes for a Sociology of Science Education'; L H T West and P J Fensham 'Prior Knowledge and the Learning of Science'. A review of Ausubel's theory of this process. Research notes include an account of the Institut fur die Padagogic der Naturwissenschaften by Gerhard Schaefer; the Research Committee for the Association of Science Education, R W West; Research Reviews; and a list of theses completed in British universities in 1971-1973 in the field of science education. Reviews include: 'Fifty Years of Research in Science Education' by John Nisbet; 'The Poverty of Logicism', J R Ravetz, and 'More Effective Biology Teaching' by Colin Wood-Robinson. 'Studies in Science Education' is published annually by the Centre for Studies in Science Education, University of Leeds, Leeds LS2, 9JT, England. Annual subscription United Kingdom and elsewhere overseas: £2.00 including postage; USA $6.50. Remittances from overseas should be in sterling. Cheques etc should be made payable to the University of Leeds and crossed. Enquiries about subscriptions and advertising should be addressed to the Business Manager, Studies in Science Education, Centre for Studies in Science Education, The University, Leeds LS2 9JT, England.

23.4 The Place of Geometry in a Mathematical Education, J V Armitage, The Mathematical Gazette, Volume LVII and No 402, December 1973, page 267

It is probably true to say that geometry has suffered most in revisions of mathematical education syllabuses at school and indeed at university level. Professor Armitage suggests that while it is over 100 years since

the Association for the Improvement of Geometrical Teaching was formed, and in spite of subsequent efforts, it is now apparent that we are faced with the subject's possible extinction in schools. The article goes on to discuss the case for and against geometry in schools and suggests an outline syllabus in geometry. It suggests that the ultimate aims of the school course in geometry should be:

- 'Familiarity with different kinds of space'
- 'The notion of a group of transformations'
- 'The structure of affine and euclidean space in 2 and 3 dimensions and an appreciation of the pleasure to be derived from rediscovering geometrical propositions and proving them'.
- 'Some understanding of the relation between geometry and the physical world - for example in mechanics, special relativity, or in a geometrical treatment of the variational principles appropriate to the treatment of Snell's Law'.

At university level projective geometry had previously occupied a central position in the structure of most mathematics syllabuses, at least until 1950. The article suggests that the decline in the treatment of geometry at this level in favour of such subjects as linear algebra has perhaps gone too far since these items are not as unrelated as might at first appear. The article proceeds to suggest ways in which the relationship could be developed with benefit to both areas. Professor Armitage is the Head of the Shell Centre for Mathematics Education, The University, Nottingham, NG7 2RD.

The Mathematical Gazette, published 4 times a year, is the journal of the Mathematics Association. Enquiries should be addressed to the Honorary Secretary at 150 Friar Street, Reading, RG1 1HE, England.

23.5 Scientific Concepts and Gaming, G I Gibbs, Programmed Learning and Educational Technology, Volume 11, No 1, January 1974 pages 32-37

This paper outlines a systems approach to teaching science to non-specialists and to giving specialists an interdisciplinary view of science. It is concerned with the nature of science in terms of the basic concepts involved in the relationships between them. 'Science maps' is a series of 5 games which enable the players to explore the generalised approach which is used. The 5 games are linked. The universe is the foundation game on which the remainder are based. The games involve the construction of conceptual models in diagrammatic form. The ideas of energy, structure, life and a chance are examined in more detail. The games are probabilistic in nature and may be used on an individual or group basis. The article describes the operation of the games.

23.6 Simulation in Science Education, P G Dean, Programmed Learning and Educational Technology, Volume 10, No 6, November 1973, page 377

There are many educational situations where the student learns by using a model and we are beginning to explore the benefits of using an interactive computer to give a greater understanding of the relationship between the model and the real situation, and also of the real situation. This article gives a broad introduction to applications in the field of sixth

form science. The author is part of the staff of Project SIMULATE at the Chelsea College Centre for Science Education. This Project was set up in 1971 to study the problems associated with the computer simulation of science experiments. 'Programmed Learning and Educational Technology' is published 6 times a year; annual subscription £5.00, postage 40p; single issues £1.00; by Sweet & Maxwell Limited, 11 New Fetter Lane, London EC4. It is the journal of the Association for Programmed Learning in Educational Technology, 33 Queen Anne Street, London W1, England.

23.7 Small Electronic Calculators, WHICH, December 1973, page 369

Small electronic calculators were, until quite recently, specialist equipment and very expensive. However, small electronic calculators may now cost less than £50 and prices are still falling. This article in WHICH attempts to compare and contrast a wide range of calculators in this grouping at present on the market and indicates the features which make calculators more or less valuable for use - such as a clear last entry key, a constant, a floating decimal point, percentage functions, memories, etc. In addition it looks at the ease of use, the ease of reading results, methods of entry and battery/mains facilities. It identifies some simple calculator problems such as overflow and inaccuracies. In all it covers 20 currently available small electronic computers and draws some obvious conclusions regarding a combination of cheapness and effectiveness. WHICH is published monthly by the Consumers Association, 14 Buckingham Street, London WC2M 6TS. It is available only to members of the Consumers Association.

24. AUSTRALIA

Australian Science Education Project (ASEP) (See SEN 21.23)

The fifth and last Newsletter of the Australian Science Education Project published in October 1973 gives details of the availability of ASEP materials. ASEP units and associated materials will probably begin to become available for purchase by schools from early in 1974. Publication of the first print of all units and service books should be complete by the end of 1974. Units will be sold in inspection packs, module packs and record packs.

The main part of each ASEP unit is its student book, which is designed so that each student can work through at his own pace. Other components include a teacher edition (incorporating the student book), and, usually, a student record book. Some units include charts, cards and 35mm transparency sets. An inspection pack is being produced which will contain a teacher edition and a record book (if there is one). A module pack will contain 10 student books, 10 record books, and enough of all other prescribed material for 10 students. A record pack will contain 40 record books and enough of any other expendable printed matter for 40 students.

The printing is being done by the Victorian Government Printer. Distribution will be from the Education Department of Victoria Stores Branch direct to schools throughout Australia. Information on procedures for ordering and distributing ASEP materials will probably be supplied to schools later this year.

Prices of units are not yet known. It is hoped that they can be kept in the vicinity of $2.50 for an inspection pack, $8.50 for a module pack and $6.00 for a record pack. The one price will apply throughout Australia and will include delivery to schools.

Due to the large financial outlay needed for the initial printing, the first print will be limited. There will be one inspection pack per unit for all schools requiring them. Supply of class materials will have to be restricted if the initial demand is high, but module and record packs will be reprinted immediately if stocks become low.

The quickest way to find details about ASEP and the materials it has developed is to read the ASEP unit for teachers, 'A Guide to ASEP'. Trial versions are available. The unit contains:

- a sample ASEP unit - 'Plants'
- a book, 'ASEP Units and Their Use', in which all units are described and suggestions are given for designing courses to include them
- the ASEP Handbook, in which the Project, its aims and philosophy are described, together with the ways in which materials have been developed and evaluated
- suggestions for the use of 'A Guide to ASEP' in teacher education programmes.

The unit is supported by audio-visuals.

Other units developed include:

Stage 1: Most Suitable for Grades 7-8 (16 units in all)

101 'Cells, the Units of Life'
102 'Earth's Changing Face'
103 'Electric Circuits'
104 'Energy and Change'
105 'Forces
106 'Made to Measure'

Stage 2: Most Suitable for Grades 8-9 (13 units in all)

201 'Atoms'
202 'Charge!'
203 'Digging Up Evidence'
204 'Foods'
205 'Life in Freshwater'
206 'Light Forms Images'

Stage 3: Most Suitable for Grades 9-10 (12 units in all)

301 'Australians - Past and Present'
302 'The Australian Scene'
303 'The Earth'
304 'Genetics
305 'How Many People?'
306 'The Human Machine'

For Teachers and Others

401 'A Guide to ASEP'

Service Books

151 'Graphing, Averaging and Reading a Scale'
152 'Heat and Temperature'
153 'Keeping Small Mammals'
154 'Making Photos
155 'Density and Pressure'
156 'Using a Microscope'

The Use of ASEP Materials

ASEP materials can be used in many different ways. However, they are best suited to a student-centred inquiry approach in which students proceed at different rates and choose work that interests them.

An integrated science course consisting entirely of ASEP units can be constructed to cover the first 3 (or 4) years of the secondary school. If different material is required sometimes, it is relatively easy to supplement ASEP materials. ASEP units can be used, in turn, as supplements in other science courses. Some advice on how all this can be done is included in the book 'Units and Their Use' which is part of unit 401, 'A Guide to ASEP'.

ASEP units can be used by one teacher in a conventional laboratory or science room, or by a team in a general studies programme, or in an open classroom situation. Many of the units go beyond traditional science into areas of art, social science, physical education, geography and history. These units are very suitable starting points for general studies activities.

The modular presentation of topics facilitates selection to suit particular student groups. Some Stage 3 units, eg 'Traffic' and 'Genetics', have been found to be very suitable for some non-science Grade 11 students. Some Stage 1 units have been used successfully with physically handicapped students and with slow learners in Grades 9 and 10.

Within units, there is further choice to suit individual needs. Each unit has several options.

If ASEP materials are to be used successfully in a student-centred inquiry approach, the role of the teacher cannot be that of the traditional lecturer-demonstrator. Many of the trials teachers commented on the drastic change they had to make. Instead of spending most of their time in front of a class, they were moving freely and giving much more assistance to individual students. Most were emphatic that they found this new role much more satisfying.

One result of considerable interest in ASEP has been visits to the Project from many leading education centres abroad. Many requests have been received from developing countries for assistance with their education programme. To try to meet the growing demand for inspection materials resource centres have been established at more than 50 places overseas. Trial versions of ASEP units are there already. For further information on these materials contact the Australian Science Education Project, 11 Glenbervie Road, Toorak 3142, Australia.

25. PERU

The October issue of the Physics Teacher, Volume 11, No 7, contains descriptions of the developments in the teaching of physics in Peru. In particular, an article on pages 401-405 describes 'A new course for physics teachers in Peru' and is written by Carlos Hernandez and Anthony Rushby. This article describes activities in the National University of Engineering (UNI) in Lima. This university is responsible for training scientists so that Peru can establish new industries based upon her own technology. It stresses, however, that without good teachers of physics at all levels of education it would be impossible to develop many projects owing to the lack of local expertise. The purpose of the article is to outline a new course which is designed to produce teachers of physics for basic courses at the universities, for whom there is a demand at the present time. This is an essential activity within the national development plan since many new industries will be created.

At present students following a course in physics attend the same classes during the first 4 years of study and may then opt for one of two alternative structures by becoming either professional physicists or physic teachers. The BSc takes a minimum of 5 years and this is normally followed by one year of research which leads to the title of Licenciate upon the publication of a thesis. The best students are encouraged to pursue the physics teachers courses. Those who opt to become teachers of physics follow these new courses and eventually obtain the degree of Licenciate as well as the BSc. The article outlines the basic philosophy of the Licenciate course emphasising the strong bias towards experimental physics. It points out the difficulties of the use of English as a second language and the problems associated with having the majority of physics textbooks written in English. There is a strong emphasis on the use of new methods and aids for teaching including films and closed circuit television amongst others. Within the educational framework of the course theory and practice of examinations and assessment are studied in depth, the students undertake comparative studies of modern materials of education which have been produced in more advanced countries,

and attempt adaptation exercises, eg of Nuffield O-level physics, which in its original form is quite inappropriate even if only from financial considerations alone. In addition they study laboratory design and develop new experiments for the general physics laboratory.

In order to proceed to the degree of Licenciate each student must write a satisfactory thesis which forms an important contribution to the teaching programme of the department. These theses have included topics on Teaching Methods for General Physics, Experiments in Electricity and Magnetism, and Angular Momentum of Rigid Bodies.

The authors of the article point out that the course is not to be regarded as a static one but as part of a dynamic evolutionary process. The description given in the article is that of the present course, but new ideas are constantly being sorted and incorporated as quickly as possible. The authors believe that this is the first course of its kind in South America and clearly is a development very much to be welcomed. It may well have significance beyond the borders of Peru.

A further article in the same issue of Physics Teacher describes the activities of the American Peace Corps in conducting in-service courses in Peru for science teachers.

The Physics Teacher is published by the American Association of Physics Teachers. Annual subscription rate $10.00 - USA, Canada and Mexico; $12.00 elsewhere. Single copies $2.00. Subscriptions should be sent to the Subscription Fulfilment Manager, American Institute of Physics, 335 East 45th Street, New York, NY 10017, USA.

26. Regional Seminar on School Science Equipment

This seminar was convened by UNESCO in cooperation with the Government of India and UNICEF at New Delhi in December 1972. The final report of this meeting is now available and is published by the UNESCO Regional Office for Education in Asia at Bangkok.

The role of science equipment and the provision of adequate quantities of the right kind of science equipment are crucial to the effective development of science education throughout the world. This seminar explored both the role of equipment in modern science teaching and the problems of procuring equipment for school science teaching in various developing countries and situations. It is interesting to note that in addition to the problems of pedagogical and industrial design, and the choice and evaluation of school science equipment, consideration was given to the marketing, manufacture, storage and distribution of school science equipment as well as to the training programmes for teachers and laboratory technicians in the use and maintenance of equipment.

While the choice of equipment is often limited by cost, some attempt to evaluate the suitability of a piece of equipment for a particular purpose should be made; for examples questions along the following lines might be asked:

Does it do the education job required?

Is it durable?

Is it easy to store and maintain?

Is it safe to use?

Is it attractive in appearance?

Is it costly?

Ultimately scientific measurement requires the extension of sensory perception and there is a limit to what can be achieved with improvisation. However, equipment should be related to the degree of sophistication of the experiment.

People concerned with the planning of new curricula and with the procurement of equipment for schools in various capacities will find this report a most interesting survey of the basic problems in this field. The report is available from UNESCO in Paris or from the UNESCO Regional Office for Education in Asia, Bangkok, Thailand.

27. West African Associations of Science Teachers (WAAST)

From 16-18 January 1974 an inaugural meeting of the West African Associations of Science Teachers (WAAST) was held in Ghana and as a result of the discussions a formal West African Associations of Science Teachers Union was set up. This is a notable advance in the long history of cooperation between the professional science teachers associations of the member countries in West Africa. The new Union elected as its officers representatives from Ghana, Nigeria and Sierra Leone. They are:

E Apea BSc Hon, Dip Ed, MEd - President
Ministry of Education (Inspectorate)
PO Box M 188, Accra - Ghana

L O Ndu BSc, Sp (Lond) - Vice President
Ezikwo High School
PO Box 56, Abakaliki - Nigeria

R O Albai, MSc (Ibadan) - Secretary General
Kwara State College of Technology
PMB 1375, Ilorin - Nigeria

Arnold O'Brien, Adv Dip in Sc Ed - Treasurer
Institute of Education
University of Sierra Leone
Tower Hill,
Freetown - Sierra Leone

E Atua - Baadu MDA (West Australia) - Editor/
Ministry of Education Publicity Officer
PO Box M45
Accra - Ghana

In view of the growing interest in regional collaboration between science teachers associations we reproduce below the objectives of the new association:

- To establish an all-embracing union of Science Teachers' Associations in West Africa with a view to promoting interchange of information and ideas about professional matters.

- To liaise between International Associations for promotion of science education and member National Science Teachers' Associations.

- To act as a clearing house for information about National Science Teachers' Associations in West Africa.

- To arrange international science workshops,conferences and other activities on trends and methods of science teaching.

- To promote exchange of science teaching personnel in West Africa.

- To publish a newsletter, journal and any other papers relating to science education.

- To encourage the formation of National Science Teachers' Associations in all countries in West Africa.

- To carry out such other objectives which may from time to time be deemed necessary by the Union.

28. Integrated Science Teaching in Asia, UNESCO-RECSAM Workshop, August, 1972

The report of this Workshop held at Penang in Malaysia in August 1972 is now available from either of the sponsoring organisations. Participants from 10 Asian countries attended the Workshop whose main objectives were:

- to stimulate participating countries to exchange experiences in integrated science teaching and to share ideas and in the development of relevant instructional materials innovations

- to prepare some sample guides and models for integrated science teaching and teacher education

- to plan strategies for the production of low cost and effective science equipment for the teaching of integrated science.

The report contains a note on plans for the introduction of integrated science courses in the seventh-ninth grades in South East Asia, together with some examples of approaches to integrated science curricula based on the conceptual approach, the environmental and the process approach. Suggestions were made for activities and materials for the education of teachers of integrated science and special attention was paid to equipment development and production for integrated science courses.

29. Sixteenth London International Youth Science Fortnight

This year's International Youth Science Fortnight will take place in London from 31 July to 14 August. The event has been organised annually since 1959 by the Council for International Contact which is an independent organisation whose aim is the promotion of international understanding through the meeting of people from all nations. Approximately 400 students generally attend of whom half come from the host country. Participants should be in the 17-22 years age range and possess a good working knowledge of English.

The programme aims to provide lectures on specialist science topics, seminars and discussion groups for exchange of ideas, visits to industrial and research establishments, presentation of papers by participants, film shows and a few optional excursions to local places of interest. Accommodation will be provided in London University Halls of Residence and the total cost of participation is expected to be around £70. This fee excludes pocket money and travel costs to and from the conference.

Further information and applications forms may be obtained from the Council for International Contact, 308 Earl's Court Road, London SW5 9BD, England.

30. IUPAP/UNESCO Conference on the Teaching of Physics

Preparations are now taking place for the holding of an international conference on the developments in the teaching of physics to be held under the auspices of the International Union of Pure and Applied Physics and UNESCO in 1975. The provisional venue is Edinburgh and provisional dates are 30 July - 6 August 1975.

31. International Information Centre for Computing in Secondary Education

The International Information Centre for Computing in Secondary Education was established in October 1973 in Moray House College of Education, Edinburgh. It is hoped that the Centre will act as a focus for the large volume of information which has accumulated in computer education during the last decade. Books, films, simulation packages and other literature mainly at the secondary level will be gathered into a resource unit to provide the opportunity for international exchange of ideas. Financial support has been provided for an initial trial period of 2 years by the Centre for Educational Research and Innovation (CERI) in the OECD in cooperation with the Scottish Education Department and the Department of Education and Science. In matters of general policy, government is effected by an international committee currently consisting of representatives from Belgium, Denmark, France, Netherlands and the United Kingdom.

In order to carry out its general aims the Centre has two sets of objectives:

Short term objectives

- To establish immediate contact with other organisations, societies or groups which have an interest in computer education but to restrict itself to secondary level.

- To affiliate with existing information systems and network so that the immediate flow of information can be effective.

- To open up the channels of communication between the Centre and its users by a. publishing a regular newsletter; b. initiating an enquiry service.

Long term objectives

- To document, as far as possible, all known sources of resource material, its location and cost (if any).

- To provide for an information retrieval system and abstracting service on articles and reports.

- To locate competent sources of advice to which enquirers can gain access.

- To compile a comprehensive directory listed by country to be called 'Data Processing in Secondary Education' listing Associations, Societies, Publications, Periodicals, Installations and Schools which are involved in computer education.

- To publish research documents or extracts from long research documents which would not otherwise be readily available.

- To help influence where possible, through competent organisations, societies or associations, fact finding projects based on the requirements of secondary computer education.

To assist with the above a variety of service activities are envisaged many of which are still in the initial planning phase. So far, however, the following have been initiated:

- An international newsletter 'The International World of Computer Education' to be published 6 times a year in English and French. Volume 1, No. 1, has just been produced and it is hoped that future issues will contain articles of current interest in all aspects of computer education.

- An enquiry service will attempt to provide useful information in response to individual requests.

- An advisory service exists to assist those involved in new developments to benefit from the experience of others in similar fields. Advisers are already available in certain fields such as the use of mini-computers in areas of low population density, classroom techniques in computer education and 'Geography and the Computer'. It is hoped that further subjects will be added rapidly.

The newsletter and all further information regarding the activities of the Centre are available from the International Information Service for Computing in Secondary Education, Moray House College of Education, Holyrood Road, Edinburgh, EH8 8AQ, Scotland.